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**Sierra Nevada Forests Bioregional Management
Indicator Species (MIS) Report:**

**LIFE HISTORY AND SUMMARY OF THE STATUS AND
TREND OF MANAGEMENT INDICATOR SPECIES
FOR 10 SIERRA NEVADA NATIONAL FORESTS**

**Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra,
Stanislaus, and Tahoe National Forests and the Lake Tahoe
Basin Management Unit**

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Sierra Nevada Forests (SNF) Bioregional Management Indicator Species (MIS) Report

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Section I. – Introduction

This Sierra Nevada Forests (SNF) Bioregional Management Indicator Species (MIS) Report is a regularly updated summary of the status and trend of Management Indicator Species (MIS) for 10 National Forests in the Sierra Nevada (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit). The SNF Bioregional MIS Report serves as the primary tool to track and report the results of bioregional monitoring of the MIS for these 10 National Forests. It is updated as new monitoring information is collected, or as necessary. It is not intended to be legally enforceable [see the Sierra Nevada Forests MIS Amendment Record of Decision (USDA Forest Service 2007a)]. The first Bioregional Monitoring Report was written in January 2008 (USDA Forest Service 2008). The information presented here represents the second Bioregional Monitoring Report.

This SNF Bioregional MIS Report is organized into five sections. This Introduction Section (Section I) introduces the Report and presents an overview of the Sierra Nevada MIS. Section II covers the bioregional habitat monitoring. Section III is an overview of bioregional population monitoring. Section IV identifies general references cited in the preceding sections. Section V is comprised of the accounts for each MIS, including a summary of the bioregional monitoring information and references cited. The Report also contains four appendices, addressing the California Wildlife Habitat Relationships System (CWHR) (Appendix A), the Calveg/CWHR Crosswalk (Appendix B), the North American Breeding Bird Survey (BBS) (Appendix C), and Snag Decay Class definitions (Appendix D).

Management Indicator Species Summary for the 10 Sierra Nevada Forest Plans.

Management Indicator Species (MIS) are animal species identified in the Sierra Nevada Forests MIS Amendment Record of Decision (ROD) signed December 14, 2007 (USDA Forest Service 2007a), which was developed under the 1982 National Forest System Land and Resource Management Planning Rule (1982 Planning Rule) (1982: 36 CFR 219). This ROD amended the Land and Resource Management Plans (LRMPs or forest plans) for 10 national forests in the Sierra Nevada [Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests (NFs) and the Lake Tahoe Basin Management Unit (LTBMU)].

The Sierra Nevada Forests (SNF) MIS Amendment ROD identified eleven (11) terrestrial habitats and ecosystem components with twelve (12) associated Management Indicator Species (MIS), and identified aquatic macroinvertebrates as the MIS for lacustrine and riverine habitat (Table 1). The ROD also identified bioregional habitat and/or population monitoring for each MIS (see Table 1). All monitoring data are collected and/or compiled at the bioregional scale and summarized in this Report.

The habitats are defined using the California Wildlife Habitat Relationship (CWHR) System (CDFG 2008, Mayer and Laudenslayer 1988). The CWHR System provides the most widely used habitat relationship models for California's terrestrial vertebrate species (Ibid). The CWHR System is described in detail in Appendix A.

Bioregional scale habitat monitoring is identified for all twelve of the terrestrial MIS. In addition, bioregional scale population monitoring, in the form of distribution population monitoring, is identified for all of the terrestrial MIS except for the greater sage-grouse. For aquatic macroinvertebrates, the bioregional scale monitoring identified is Index of Biological Integrity and Habitat.

There are a myriad of approaches for monitoring populations of MIS, from simply detecting presence to detailed tracking of population structure (USDA Forest Service 2001, Appendix E, page E-19). A distribution population monitoring approach is identified for all 12 of the terrestrial MIS in the 2007 SNF MIS Amendment ROD, except for the greater sage-grouse (USDA Forest Service 2007a). Distribution population monitoring consists of collecting presence data for the MIS across a number of sample locations over time. Presence data can be collected using a number of direct and indirect methods, such as surveys (population surveys), bird point counts, tracking number of hunter kills, counts of species sign (such as deer pellets), and so forth. The specifics regarding how these presence data are assessed to track changes in distribution over time vary by species and the type of presence data collected.

For aquatic macroinvertebrates, the River InVertebrate Prediction And Classification System (RIVPACS) predictive model is applied, and habitat condition and trend is measured by tracking the condition and trend of a representative community of aquatic macroinvertebrates and measuring physical habitat attributes to relate to the condition of the biological community within perennial water bodies.

Table 1 is a summary of the MIS for the Sierra Nevada Forests, including the habitat or ecosystem component each species was selected to represent, the CWHR System definitions for each habitat/ecosystem component, the type of bioregional monitoring required for each MIS, and the national forest to which each MIS applies.

Table 1. Management Indicator Species (MIS) for the ten Sierra Nevada National Forests (USDA Forest Service 2007a).

Habitat / Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component ¹	MIS <i>Scientific name</i>	Monitoring ²	Eldorado	Inyo	Lassen	Modoc	Plumas	Sequoia	Sierra	Stanislaus	Tahoe	LTMBU
Riverine and Lacustrine	lacustrine (LAC) and riverine (RIV)	Aquatic Macroinvertebrates	IBI/H	X	X	X	X	X	X	X	X	X	X
Shrublands (West-slope chaparral types)	montane chaparral (MCP), mixed chaparral (MCH), chamise-redshank chaparral (CRC)	Fox sparrow <i>Passerella iliaca</i>	HP	X		X		X	X	X	X	X	
Sagebrush	sagebrush (SGB), low sagebrush (LSG)	Greater sage-grouse <i>Centrocercus urophasianus</i>	H		X		X						
Oak-Associated Hardwoods & Hardwood/Conifers	montane hardwood (MHW), montane hardwood- conifer (MHC)	Mule deer <i>Odocoileus hemionus</i>	HP	X		X		X	X	X	X	X	
Riparian	montane riparian (MRI), valley foothill riparian (VRI)	Yellow warbler <i>Dendroica petechia</i>	HP	X	X	X	X	X	X	X	X	X	X
Wet Meadow	wet meadow (WTM), freshwater emergent wetland (FEW)	Pacific treefrog ³ <i>Pseudacris regilla</i>	HP	X	X	X	X	X	X	X	X	X	X
Coniferous Forest, early seral	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, and 3, all canopy closures	Mountain quail <i>Oreortyx pictus</i>	HP	X	X	X	X	X	X	X	X	X	X
Coniferous Forest, mid seral	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 4, all canopy closures	Mountain quail <i>Oreortyx pictus</i>	HP	X	X	X	X	X	X	X	X	X	X
Coniferous Forest, late seral, open canopy	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P	Sooty (Blue) grouse <i>Dendragapus obscurus</i> or <i>Dendragapus fuliginosus</i>	HP	X	X	X	X	X	X	X	X	X	X
Coniferous Forest, late seral, closed canopy	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), tree size 5 (canopy closures M and D), and tree size 6.	Spotted owl <i>Strix occidentalis occidentalis</i>	HP	X	X	X		X	X	X	X	X	X
		American marten <i>Martes americana</i>	HP	X	X	X	X		X	X	X	X	X
		Northern flying squirrel <i>Glaucomys sabrinus</i>	HP	X	X	X	X	X	X	X	X	X	X
Snags within green forest	medium (15-30" dbh) and large (>30" dbh) snags in green forest	Hairy woodpecker <i>Picoides villosus</i>	HP	X	X	X	X	X	X	X	X	X	X
Snags within burned forest	medium (15-30" dbh) and large (>30" dbh) snags in burned forest (stand-replacing fire)	Black-backed woodpecker <i>Picoides arcticus</i>	HP	X	X	X	X	X	X	X	X	X	X

¹ All CWHR size classes and canopy closures are included unless otherwise specified; **dbh** = diameter at breast height; **Canopy Closure classifications:** S=Sparse Cover (10-24% canopy closure); P= Open cover (25-39% canopy closure); M= Moderate cover (40-59% canopy closure); D= Dense cover (60-100% canopy closure); **Tree size classes:** 1 (Seedling)(<1" dbh); 2 (Sapling)(1"-5.9" dbh); 3 (Pole)(6"-10.9" dbh); 4 (Small tree)(11"-23.9" dbh); 5 (Medium/Large tree)(≥24" dbh); 6 (Multi-layered Tree in PPN and SMC) (Mayer and Laudenslayer 1988).

² Monitoring Types, all tracked at the Sierra Nevada Scale: IBI/H = Index of Biological Integrity and Habitat Trend Monitoring; HP = Habitat Trend and Distribution Population Monitoring; H = Habitat trend monitoring;

³ Pacific treefrog is now called the Pacific Chorus Frog.

Section I. Habitat Monitoring.

The SNF MIS Amendment ROD identifies bioregional habitat and ecosystem component monitoring that will track the status and trends at the Sierra Nevada scale of each of the CWHR habitat types and ecosystem components listed in Table 1.

Methodology for Determining Habitat Status and Trend.

MIS habitat status and trend is determined using vegetation monitoring data collected by the Pacific Southwest Region Remote Sensing Laboratory (RSL): resource photography, satellite imagery, and ground based inventory sampling, including the national Forest Inventory and Analysis (FIA) inventories and regional augmentation of FIA inventories (targeting non-forest and rare vegetation types). The RSL vegetation monitoring program covers approximately 21 million acres of National Forest System lands within the Pacific Southwest Region, including the Sierra Nevada. For the past 15 years, a 5-year cycle consisting of five areas of approximately 4 million acres each were identified as project areas for organizing mapping and monitoring work. Due to reductions in budgets and changes in the FIA programs from periodic to annual, a 10-year schedule is now being considered, consisting of an average of 2.1 million acres each year.

Each year, up to three adjacent National Forests are identified for acquiring aerial photography and imagery. Vegetation map updates are scheduled the following year for these same Forests. Activity information (wildfire, harvest and fuel treatments, and pest mortality) and change detection are used to target updates in the existing vegetation maps. Forest inventory re-measurements are ongoing at 10 percent annually across all lands. However, specific plots may need to be scheduled for re-measurement where changes have occurred from fire, harvest, or other major landscape changes since the last measurement date. Details regarding the protocols used, as well as the data collected, can be found at: <http://www.fs.fed.us/r5/rsl/projects/>.

Each MIS habitat is defined using CWHR; the crosswalk between CWHR and each data set is presented in Appendix B. The Geospatial Interface (GI) Tool was used to compute the MIS Habitats identified in Table 1. Some manipulation and cleanup of older layers was done to correct for changes in administrative boundaries, and on some of the early seral conifer habitat classes because of changes in methods used in classification today.

For the first habitat monitoring cycle (Table 2), the most current data available for each National Forest in early 2008 (vegetation classification periods 1999-2000) were analyzed by the RSL. In order to estimate a trend, the habitat data from the Sierra Nevada Ecosystem Project (SNEP) (approximately 10 years) were used for “early 1990s.” Each of the two data sets were collected and classified over multiple years across the 10 national forests, as it is not logistically possible to collect and classify vegetation data across the 10 national forest simultaneously (Table 2).

For the second (current) habitat monitoring cycle, classification periods 1999-2000 were compared with the most current monitoring data available for each National Forest as of October 2010 (vegetation classification periods 1999-2008) (Table 3). As noted in Table 3, the map scale changed between the two classification periods for some forests.

Changes in habitat acres can be partially attributed to changes in map scale (for example, see Figure 1).

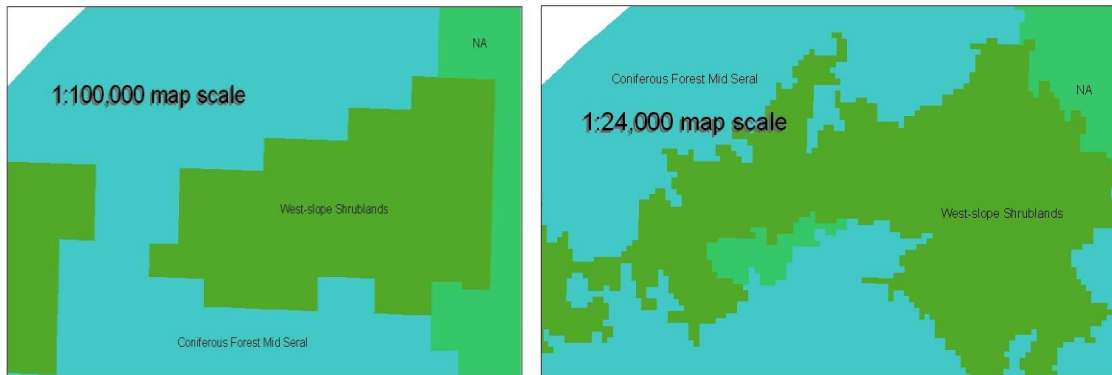
Table 2. Vegetation Classification Periods by National Forest, Monitoring Cycle #1.

National Forest	Vegetation Classification Period - Early 1990s	Vegetation Classification Period - Current	Difference (years)
Eldorado NF	1991	2000	9
Inyo NF	1991	2001	10
Lassen NF	1991	1999	8
Modoc NF	1990	2004	14
Plumas NF	1993	2000	7
Sierra NF	1992	2001	9
Sequoia NF	1992	2001 ^I	9
Stanislaus NF	1994	2000	6
LTBMU	1991	2000	9
Tahoe NF	1992	2000	8

^I Sequoia NF 2001 imagery was updated 2003 to reflect change due to the McNally Fire (2002).

Table 3. Vegetation Classification Periods by National Forest, Monitoring Cycle #2.

National Forest	Vegetation Classification Year-Previous	Vegetation Classification Year-Current	Map Scale Previous	Map Scale Current	Difference (years)
Eldorado NF	2000	2005	1: 100,000	1:24,000	5
Inyo NF	2001	2008	1:24,000	1:24,000	7
Lassen NF	1999	1999	1: 100,000	1: 100,000	0
Modoc NF	2004	2004	1:24,000	1:24,000	0
Plumas NF	2000	2000	1: 100,000	1: 100,000	0
Sierra NF	2001	2007	1:24,000	1:24,000	6
Sequoia NF	2001	2007	1:24,000	1:24,000	6
Stanislaus NF	2000	2005	1: 100,000	1:24,000	5
LTBMU	2000	2005	1: 100,000	1:24,000	5
Tahoe NF	2000	2000	1: 100,000	1: 100,000	0

Figure 1. Example of effects of monitoring scale change on amount of habitat.**Methodology for Determining Ecosystem Component (Snag) Status and Trend.**

The current status of the snag ecosystem component for both green and burned forests was calculated using the latest compiled vegetation inventories [sampled Forest Inventory and Analysis (FIA) plots] and vegetation strata population maps for the 10 Sierra Nevada national forests (Table 3). Snags of all tree species were tracked by size [Medium (15-29.9" dbh) and Large (≥ 30 " dbh)], decay class (1-5, see Appendix D), and number per acre (inventory strata averages) by national forest. These numbers were then expanded by mapped strata acres. The weighted average by major forest type was then calculated for each national forest. These were then summed to produce a weighted average by major forest type across the 10 Sierra Nevada national forests.

In order to estimate a trend, data from the sampled FIA plots from the 2000s were used (Table 4) and total snags ≥ 15 " dbh per acre by major forest type were compared with the current data.

These data include snags in both green forest and burned forest, and data on the status of burned forest in the Sierra Nevada was also tracked.

Table 3. Source information for snag status estimates – Current Status.

National Forest	Vegetation Map Date	Panel Measurement Dates	Inventory Type
Eldorado NF	2005	2001-2007	Annual
Inyo NF	2008	2001-2009	Annual
Lassen NF	1999	2002	Periodic
Modoc NF	2004	2001-2007	Annual
Plumas NF	2000	2003	Periodic
Sierra NF	2007	2001-2008	Annual
Sequoia NF	2007	2001-2008	Annual
Stanislaus NF	2005	2001-2007	Annual
Tahoe NF	2000	2003	Periodic
LTBMU	2005	2001-2007	Annual

Table 4. Source information for snag status estimates – Past Data.

National Forest	Vegetation Map Date	Sampled FIA Plots Dates	Inventory Type
Eldorado NF	2000	2003	Periodic
Inyo NF	2001	2001-2004	Annual
Lassen NF	1999	2002	Periodic
Modoc NF	1999	2002	Periodic
Plumas NF	2000	2003	Periodic
Sierra NF	2003	2001-2004	Annual
Sequoia NF	2001	2001-2004	Annual
Stanislaus NF	2000	2003	Periodic
Tahoe NF	2000	2003	Periodic
LTBMU	2000	2003	Periodic

Bioregional Habitat Status and Trend.

The habitat trend for nine of the habitat types is summarized in Table 5. In addition, Figures 2 and 3 display the current (Figure 2) and early 1990s (Figure 3) percentages across all ownerships. (Percentages for just NFS lands are presented in Table 5). The ‘other’ category includes all the vegetation types not included in the 10 MIS habitat types.

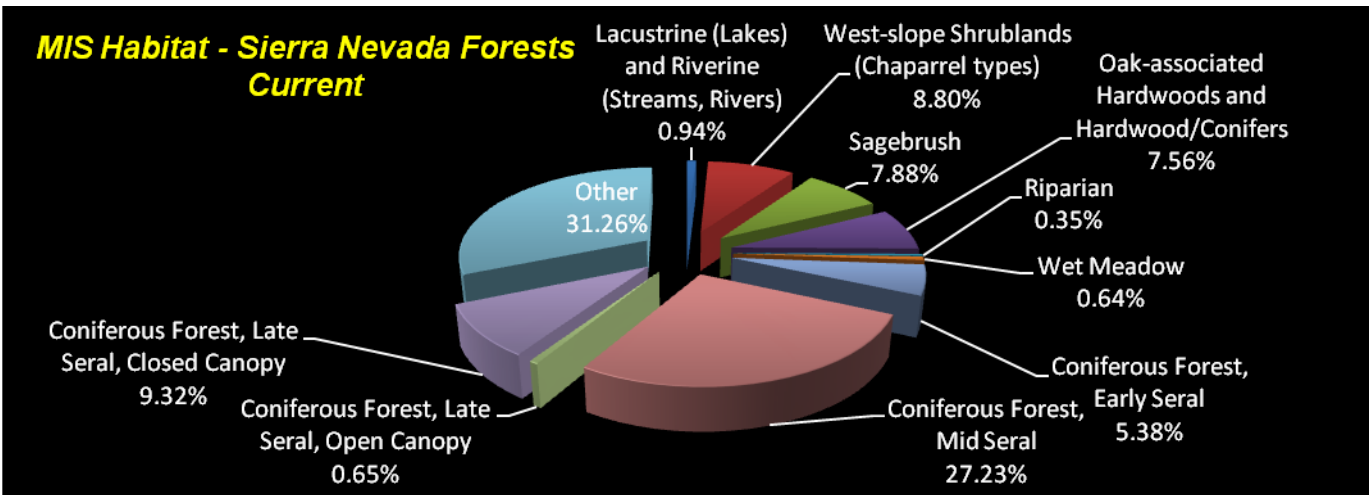


Figure 2. Current Habitat for Sierra Nevada Forests MIS at the Bioregional Scale. All ownerships.

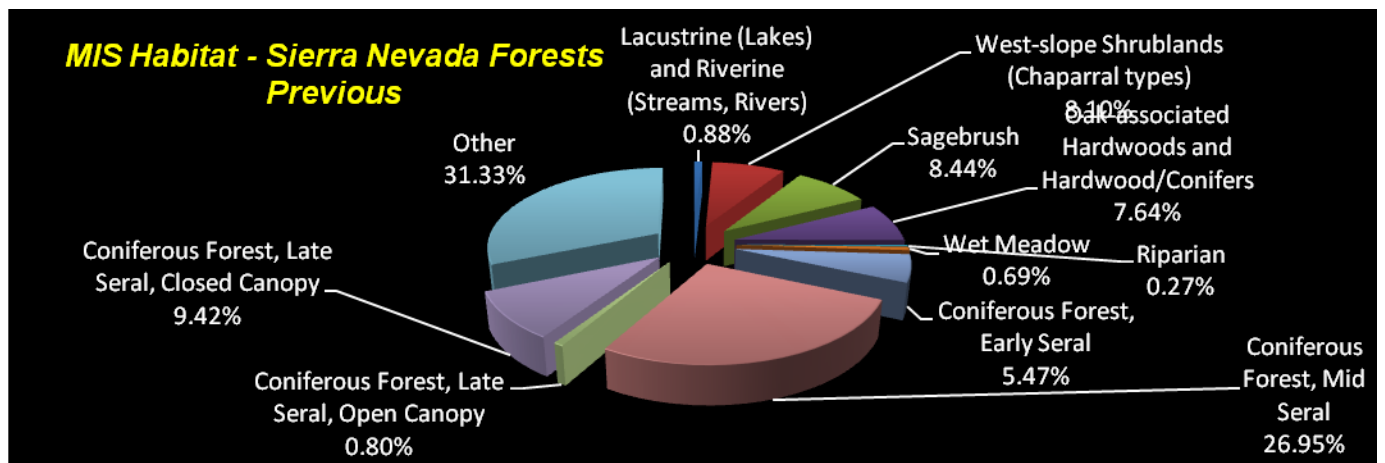


Figure 3. Early 2000s Habitat for Sierra Nevada Forests MIS at the Bioregional scale, all ownerships.

Table 5. Trend of Habitat for Sierra Nevada Forests MIS at the Bioregional Scale.

Habitat Type	Acres During the Early 1990s		Acres During the Early 2000s		Acres During Current Vegetation Classification Period		Difference between early 2000s & Current, NFS Lands		Difference between early 1990s & Current, NFS Lands	
	NFS lands Acres (%)	Total ¹ Acres	NFS lands Acres (%)	Total ¹ Acres	NFS Lands Acres (%)	Total ¹ Acres	Acres	%	Acres	%
Lacustrine (Lakes) and Riverine (Streams, Rivers)	85,486 (1%)	113,534	85,486 (1%)	113,534	92,041 (1%)	120,088	+6,555	0%	+6,555	0%
West-slope Shrublands (Chaparral types)	914,200 (8%)	1,091,744	921,799 (8%)	1,039,142	1,009,681 (9%)	1,128,859	+87,882	+1%	+95,481	+1%
Sagebrush	839,872 (8%)	881,985	997,915 (9%)	1,083,024	919,250 (8%)	1,010,908	-78,665	-1%	+79,378	0%
Oak-associated Hardwoods and Hardwood/Conifers	515,767 (5%)	614,287	808,737 (7%)	980,776	808,006 (7%)	969,565	-731	0%	+292,239	+2%
Riparian	21,252 (<1%)	24,029	28,641 (<1%)	34,765	38,140 (<1%)	44,765	+9,499	0%	+16,888	0%
Wet Meadow	154,165 (1%)	170,809	65,687 (1%)	88,722	61,247 (1%)	82,584	-4,440	0%	-92,918	0%
Coniferous Forest, Early Seral	988,881 (9%)	1,076,736	545,653 (5%)	701,312	530,851 (5%)	690,341	-14,802	0%	-458,030	-4%
Coniferous Forest, Mid Seral	2,320,436 (21%)	2,722,284	2,765,872 (25%)	3,457,803	2,776,022 (25%)	3,492,427	+10,150	0%	+455,586	+4%
Coniferous Forest, Late Seral, Open Canopy	339,736 (3%)	398,781	75,412 (1%)	102,437	63,795 (1%)	83,048	-11,617	0%	-275,941	-2%
Coniferous Forest, Late Seral, Closed Canopy	736,120 (7%)	859,052	994,214 (9%)	1,208,270	1,006,923 (9%)	1,195,595	-12,709	0%	+270,803	+2%
Other	3,996,987 (38%)	4,853,611	3,644,425 (33%)	4,019,760	3,630,628 (33%)	4,009,242	-13,797	0%	-366,359	-5%
Grand Total	10,933,993	12,829,739	10,933,842	12,829,545	10,936,583	12,827,423	n/a	n/a	n/a	n/a

¹ All Ownerships.

Bioregional Habitat Trend Summary: These data indicate that, during this timeframe, the changes observed in the first vegetation monitoring cycle within the coniferous forest types appear to have continued: a slight increase in closed canopy late seral coniferous forest with a corresponding decrease in open canopy late seral coniferous forest and an increase in mid seral coniferous forest with a corresponding decrease in early seral coniferous forest.

Bioregional Ecosystem Component (Snag) Status and Trend.

The current (based on average number of medium-sized and large-sized snags (≥ 15 " dbh, all decay classes) per acre across the primary coniferous and hardwood forest types (westside mixed conifer, ponderosa pine, white fir, productive hardwoods, red fir, eastside pine) in the Sierra Nevada ranges from 1.5 per acre in eastside pine to 9.1 per

acre in white fir. In 2008, snags in these types ranged from 1.4 per acre in eastside pine to 8.3 per acre in white fir (USDA Forest Service 2008). The current snag data for all regional forest types in the Sierra Nevada by size class and decay class is presented in Table 6.

Table 6. Current Snags per Acre by Size Class¹ and Decay Class² by Regional Forest Type for the 10 Sierra Nevada Forests.

Regional Forest Type	Snag Size Class ¹ and Decay Class ²										TOTAL
	M_1	M_2	M_3	M_4	M_5	L_1	L_2	L_3	L_4	L_5	
Westside mixed conifer	0.9	1.1	0.8	0.6	0.2	0.1	0.3	0.2	0.3	0.1	4.6
Ponderosa pine	0.4	0.5	0.8	0.5	0.1	0.1	0.1	0.2	0.1	0.0	2.8
White fir	2.8	2.2	1.7	0.9	0.2	0.1	0.5	0.4	0.3	0.1	9.1
Mixed Conifer with Giant Sequoia	0.6	1.1	1.2	0.7	0.1	0.3	0.4	0.5	1.6	0.3	6.9
Hardwoods (productive)	0.5	0.5	0.3	0.2	0.0	0.0	0.1	0.2	0.1	0.0	2.0
Red fir	1.2	1.4	1.1	0.7	0.2	0.4	0.5	0.7	0.4	0.1	6.7
Alpine	0.5	1.2	1.2	0.4	0.0	0.2	0.2	0.5	0.1	0.0	4.3
Lodgepole pine	1.0	1.5	0.8	0.1	0.1	0.2	0.2	0.2	0.1	0.1	4.2
Jeffrey pine	0.5	0.7	0.3	0.2	0.0	0.1	0.2	0.1	0.1	0.0	2.3
Eastside mixed conifer	1.2	1.3	1.1	0.6	0.1	0.1	0.3	0.4	0.2	0.1	5.5
Eastside pine	0.4	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	1.5
Pinyon-Juniper	0.4	0.4	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	1.3
Knobcone pine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardwoods (non-productive)	0.3	0.3	0.4	0.1	0.0	0.0	0.1	0.1	0.0	0.0	1.3
Shrub types (productive)	0.9	0.4	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.2	2.7
Shrub types (non-productive)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Non-forest types	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7

¹ M = Medium Snag Size Class, 15-29.9 inches Diameter at Breast Height;

L = Large Snag Size Class, 30 + inches Diameter at Breast Height.

² Snag Decay Classes 1 to 5 (Cline et al. 1980, USDA Forest Service 2007b) (See Appendix D).

Data from the early-to-mid 2000s (see dates in Table 4) were compared with the current data (see dates in Table 3) to calculate the trend in total snags per acre by Regional forest type for the 10 Sierra Nevada national forests (Table 7). These data indicate that, during this period, snags per acre increased within westside mixed conifer (+0.16), white fir (+2.66), productive hardwoods (+0.35), and red fir (+1.25) and decreased within ponderosa pine (-0.17) and eastside pine (-0.14).

These trends are similar to the trends observed in the 2008 Bioregional Report for westside mixed conifer, white fir, and red fir, ponderosa pine, and eastside pine. However, productive hardwoods, which showed a slight decreasing trend (0-0.17) in 2008, is now showing a slight increasing trend (+0.35) (USDA Forest Service 2008).

Table 7. Trend in total snags per acre (all snags equal to or greater than 15 inches dbh) by Regional Forest Type for 10 Sierra Nevada Forests.

Regional Forest Type	Past total Snags Per Acre ¹	Current Total Snags Per Acre ²	Difference in Snags Per acre
Westside mixed conifer	3.86	4.61	0.76
Ponderosa pine	2.94	2.78	-0.16
White fir	6.40	9.06	2.66
Mixed Conifer with Giant Sequoia	5.55	6.86	1.31
Hardwoods (productive)	1.65	2.01	0.35
Alpine	3.77	4.25	0.48
Jeffrey pine	1.79	2.32	0.53
Lodgepole pine	3.86	4.17	0.30
Red fir	5.41	6.66	1.25
Eastside pine	1.65	1.51	-0.14
Eastside mixed conifer	5.70	5.52	-0.18
Knobcone pine	0.00	0.01	0.01
Pinion-Juniper	0.95	1.26	0.31
Hardwoods (non-productive)	1.07	1.25	0.18
Shrub types (productive)	1.97	2.66	0.69
Shrub types (non-productive)	0.39	0.51	0.12
Non-forest types	0.36	0.69	0.33

¹ See Table 4 for data collection dates.² See Table 3 for data collection dates.

These data include snags in both green forest and burned forest. Sierra Nevada wild fires over 1,000 acres in size that occurred between 2000 and 2007 are summarized in Table 8 and displayed in Figure 4. Fires were tracked by forest by acres in four severity classes. Between 2000 and 2007, 211,000 acres underwent severe burn and 176,000 acres underwent moderate burn in the Sierra Nevada.

Table 18. SN Forest fire burn severity acres for fires over 1,000 acres, 2000 to 2007.

Forest	Unknown¹	Unchanged²	Low Burn³	Moderate Burn⁴	Severe Burn⁵	Grand Total
Eldorado NF		3,192	8,302	10,766	13,808	36,067
Inyo NF	11,184	5,006	15,599	18,105	33,149	83,043
Lassen NF		10,986	11,345	5,832	5,886	34,050
Modoc NF	15,499	9,195	9,641	10,705	16,240	61,280
Plumas NF		3,754	21,975	34,916	62,568	123,213
Sequoia NF	6,751	26,026	47,586	75,840	61,828	218,031
Sierra NF		364	1,595	2,320	1,385	5,665
Stanislaus NF		2,999	9,543	11,053	5,934	29,529
Tahoe NF		2,640	8,277	5,843	8,290	25,049
LBTMU		172	340	888	1,615	3,014
Total	33,434	64,335	134,203	176,267	210,703	618,941

¹ Includes two 2006 Wildlife Fire Use / Appropriate Management Response timbered fires on Sequoia NF that have not yet been processed, and unknown severity fires on Inyo NF and Modoc NF in Pinyon/Juniper and shrubland vegetation types.

² Unchanged: The area one year after the fire was indistinguishable from pre-fire conditions.

³ Low: Areas with little change in cover and little mortality of the structurally dominant vegetation.

⁴ Moderate: There is a mixture of effects on the structurally dominant vegetation.

⁵ High: Areas where the dominant vegetation has high to complete mortality.

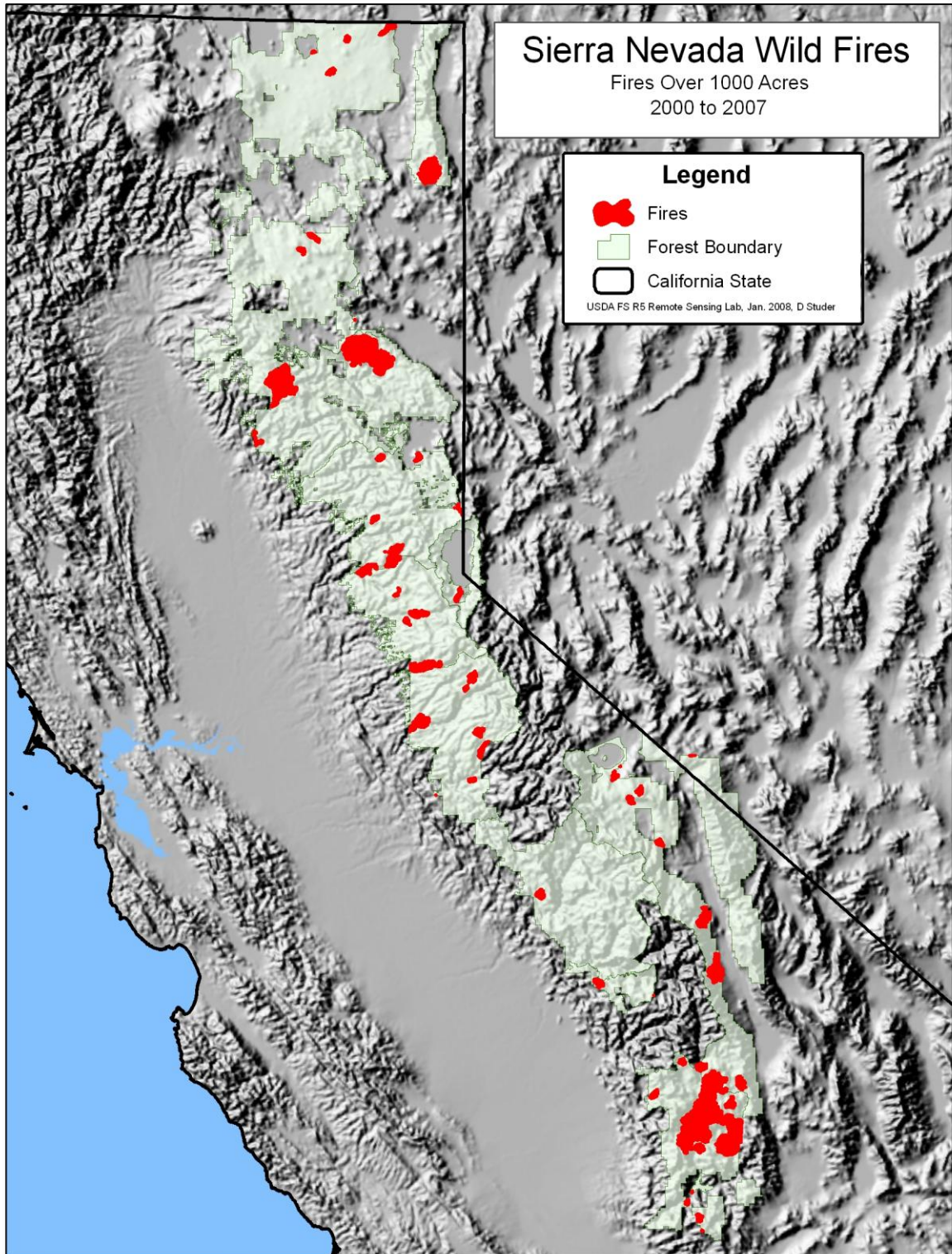


Figure 4. Sierra Nevada wild fires over 1,000 acres in size from 2000 to 2007.

Section III. Population Monitoring.

A distribution population monitoring approach is identified for all 12 of the terrestrial MIS in the 2007 SNF MIS Amendment ROD, except for the greater sage-grouse (USDA Forest Service 2007a). Population information for each MIS is presented at biologically meaningful scales, including range-wide/nation-wide, California, and province (Sierra Nevada). A variety of types of population data are presented, including presence/absence, frequency of occurrence, relative abundance, vital rates, and range distribution measures. These types of data at various scales are important to assess distribution population trend and provide context for status and trend at the bioregional scale.

Monitoring efforts for each terrestrial MIS are summarized under each MIS account. In addition to the results of monitoring efforts specifically designed to target Sierra Nevada MIS, data from other on-going monitoring efforts are summarized under the applicable MIS account. These on-going monitoring efforts include Sierra Nevada Forest Plan Amendment (SNFPA) monitoring (USDA Forest Service 2005, 2006, 2007c, 2009, 2010); Plumas-Lassen Study (Sierra Nevada Research Center 2007, 2008, 2009); California Partners in Flight focal species monitoring (<http://www.prbo.org/calpif/data.html>); Monitoring Avian Productivity and Survivorship (MAPS) (Siegel and Kaschube 2007, DeSante and Kaschube 2009); and California Department of Fish and Game surveys, assessments, and modeling (CDFG 2004a, CDFG 2004b, CDFG 2007, CDFG 2010). In addition, a large and valuable data set that provides population information for most diurnal bird MIS is the data set from the United States Geological Survey (USGS) North American Breeding Bird Survey. Details regarding Breed Bird Survey (BBS) data are presented in Appendix C.

For aquatic macroinvertebrates, condition and trend is determined by analyzing the data using the predictive, multivariate model (RIVPACS) (Hawkins 2003) to determine whether the macroinvertebrate community has been impaired relative to reference condition within perennial water bodies. This monitoring consists of collecting aquatic macroinvertebrates and measuring stream habitat features according to the Stream Condition Inventory (SCI) manual (Frasier et al. 2005). Evaluation of the condition of the biological community is based upon the “observed to expected” (O/E) ratio, which is a reflection of the number of species observed at a site versus the number expected to occur there in the absence of impairment. Sites with a low O/E scores have lost many species predicted to occur there, which is an indication that the site has a lower than expected richness of sensitive species and is therefore impaired.

Section IV. General References Cited In Above Sections

(note: literature cited under individual MIS Accounts are listed in the applicable MIS Account).

California Partners in Flight focal species monitoring:

<http://www.prbo.org/calpif/data.html>

CDFG (California Department of Fish and Game). 2004a. Resident Game Bird Hunting Final Environmental Document. August 5, 2004. State of California, The Resources Agency, Department of Fish and Game. 182 pp + appendices.

CDFG (California Department of Fish and Game). 2004b. Report of the 2004 Game Take Hunter Survey. State of California, The Resources Agency, Department of Fish and Game. 20pp.

CDFG (California Department of Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

California Department of Fish and Game. California Interagency Wildlife Task Group. 2008. Users manual for version 8.2 of the California Wildlife Habitat Relationships System and Bioview. Sacramento, California.

CDFG (California Department of Fish and Game). 2007. Deer Hunting Final Environmental Document, April 10, 2007. State of California, The Resources Agency, Department of Fish and Game. 80pp + appendices.

CDFG (California Department of Fish and Game). 2008. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) Version 8.2 personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/>

CDFG (California Department of Fish and Game). 2010. Data supplement to the California Fish and Game Commission regarding: Recommended 2010 Deer Tag Allocations (Updated 2009 Deer Harvest and Population Estimates). April 21, 2010. State of California, The Resources Agency, Department of Fish and Game. 34pp.

Cline, S.P., A.B. Berg, and H.M. Wight. 1980. Snag characteristics and dynamics in Douglas-fir forests, Western Oregon. J.Wildlife Mgmt 44(4):773-786.

DeSante, D.F., and D.R. Kaschube. 2009. The monitoring avian productivity and survivorship (MAPS) program 2004, 2005, and 2006 report. Bird Populations 9:86-169.

Frazier J.W., K.B. Roby, J.A. Boberg, K. Kenfield, J.B. Reiner, D.L. Azuma, J.L. Furnish, B.P. Staab, S.L. Grant. 2005. Stream Condition Inventory Technical Guide. USDA Forest Service, Pacific Southwest Region - Ecosystem Conservation Staff. Vallejo, CA. 111 pp.

Hawkins, C.P. 2003. Development, evaluation, and application of a RIVPACS-type predictive model for assessing the biological condition of streams in Region 5 (California) national forests. Completion Report. Western center for Monitoring and Assessment of Fresh Water Ecosystems. Utah State University. Logan, Utah 23 pp.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp. http://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp

Remote Sensing Laboratory data: <http://www.fs.fed.us/r5/rsl/projects/classification/cv-cwhr-xwalk.html>

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

Sierra Nevada Research Center. 2008. Plumas Lassen Study 2007 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 310pp. http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2007.pdf

Sierra Nevada Research Center. 2009. Plumas Lassen Study 2008 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 223pp. http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2008.pdf

Sierra Nevada Research Center. 2010. Plumas Lassen Study 2009 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 184pp. http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2009.pdf

Siegel, R.B. and D.R. Kaschube. 2007. Landbird Monitoring Results from the Monitoring Avian Productivity and Survivorship (MAPS) Program in the Sierra Nevada. Final report in fulfillment of Forest Service Agreement No. 05-PA-11052007-141. The Institute for Bird Populations. February 13, 2007. 33pp. http://www.birdpop.org/DownloadDocuments/sn5_final_report.pdf

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. January 2001.

USDA Forest Service. 2005. Sierra Nevada forest plan accomplishment monitoring report for 2004. USDA Forest Service, Pacific Southwest Region R5-MR-026. 8pp.

USDA Forest Service. 2006. Sierra Nevada forest plan accomplishment monitoring report for 2005. USDA Forest Service, Pacific Southwest Region R5-MR-000. 12pp.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA Forest Service. 2007b. Forest Inventory and Analysis (FIA) National Core Field Guide, Volume 1: Field Data Collection Procedures for Phase 2 Plots, National Core Field Guide, Version 4.0, October 2007.

USDA Forest Service. 2007c. Sierra Nevada forest plan accomplishment monitoring report for 2006. USDA Forest Service, Pacific Southwest Region R5-MR-149. 12pp.

USDA Forest Service. 2008. Sierra Nevada Forests Bioregional Management Indicator Species (MIS) Report: Life history and analysis of Management Indicator Species of the 10 Sierra Nevada National Forests: Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit. Pacific Southwest Region, Vallejo, CA. January 2008. 128pp.

USDA Forest Service. 2009. Sierra Nevada forest plan accomplishment monitoring report for 2007. USDA Forest Service, Pacific Southwest Region. On-line version. <http://www.fs.fed.us/r5/snfpa/monitoringreport2007/>

USDA Forest Service. 2010. Sierra Nevada forest plan accomplishment monitoring report for 2008. USDA Forest Service, Pacific Southwest Region. On-line version. <http://www.fs.fed.us/r5/snfpa/monitoringreport2008/>

Section V. Management Indicator Species (MIS) Accounts

Introduction

The Management Indicator Species (MIS) Accounts in this document are based on the current information on life history, habitat relationships, past and present suitable habitat, and population information for each MIS. The accounts are presented alphabetically by MIS common name. Each MIS Account is divided into the following sections:

- I. Overview of Species
- II. Habitat Relationships
- III. Habitat Status and Trend
- IV. Population Status and Trend
- V. Population Status and Trend Summary for the Sierra Nevada National Forests;
- References Cited.

To be biologically meaningful, this information is discussed at a variety of spatial scales, including the range of the species, State (i.e., California), and Province (i.e., Sierra Nevada).

The sections within each species account, as well as associated tables and figures, are identified by a species-specific alphabetical indicator generally composed of the first 1-2 letters of each of part of the common name:

American marten	AMMA
Aquatic (benthic) macroinvertebrates	BMI
Black-backed woodpecker	BLWO
California spotted owl	CASPO
Fox sparrow	FOSP
Greater sage-grouse	GRSA
Hairy woodpecker	HAWO
Mountain quail	MOQU
Mule deer	MUDE
Northern flying squirrel	NOFLS
Pacific treefrog	PATR
Sooty (blue) grouse	SOGR
Yellow warbler	YEWA

American Marten (*Martes americana*) (AMMA)

AMMA-I. Overview of Species.

The American marten (*Martes americana*) is a Management Indicator Species (MIS) for late seral closed canopy coniferous forest habitat on nine of the Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007a).

The marten occurs from the southern Rockies in New Mexico northward to the treeline in Canada and Alaska, and from the southern Sierra Nevada eastward to Newfoundland in Canada; in Canada and Alaska, martens have a vast and continuous distribution, but in the contiguous western United States, martens are limited to mountain ranges within a narrow band of coniferous forest habitats (NatureServe 2007) (Figure AMMA-I-1). In California, martens are currently distributed throughout the Sierra Nevada and Cascades, primarily from 5,500 to 10,000 feet, and they are most often found in the Sierra Nevada above 7,200 feet (CDFG 2005, Kucera et al. 1995, Zielinski et al. 2005) (Figure AMMA-I-2).

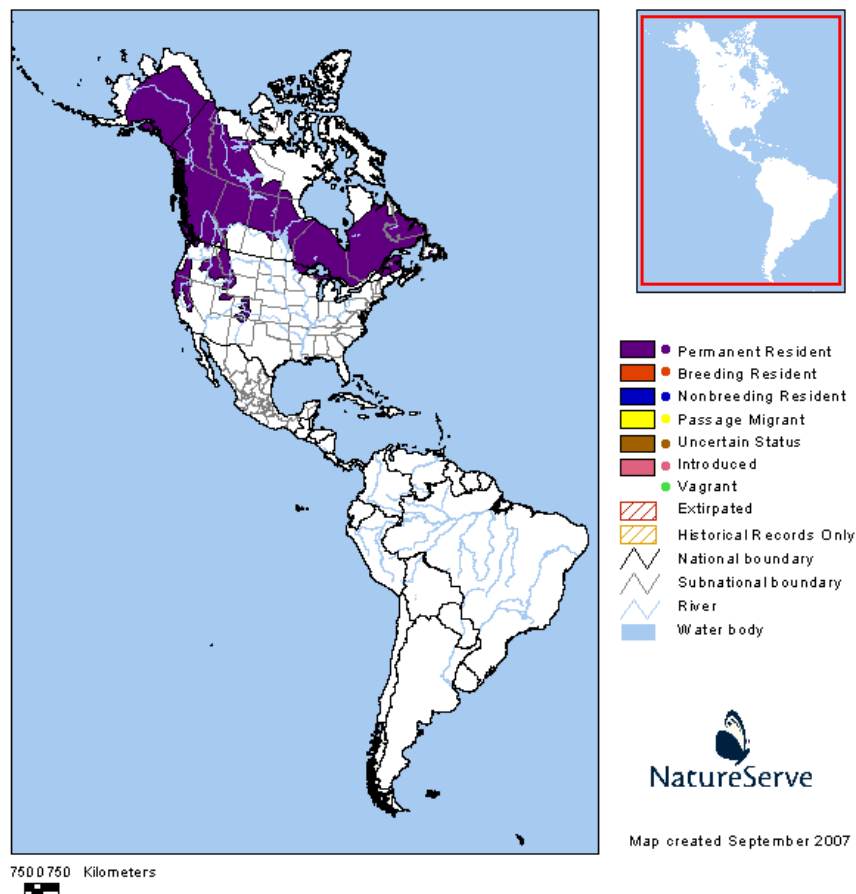


Figure AMMA-I-1. Range-wide distribution of American marten (Patterson et al. 2003 in NatureServe 2007).

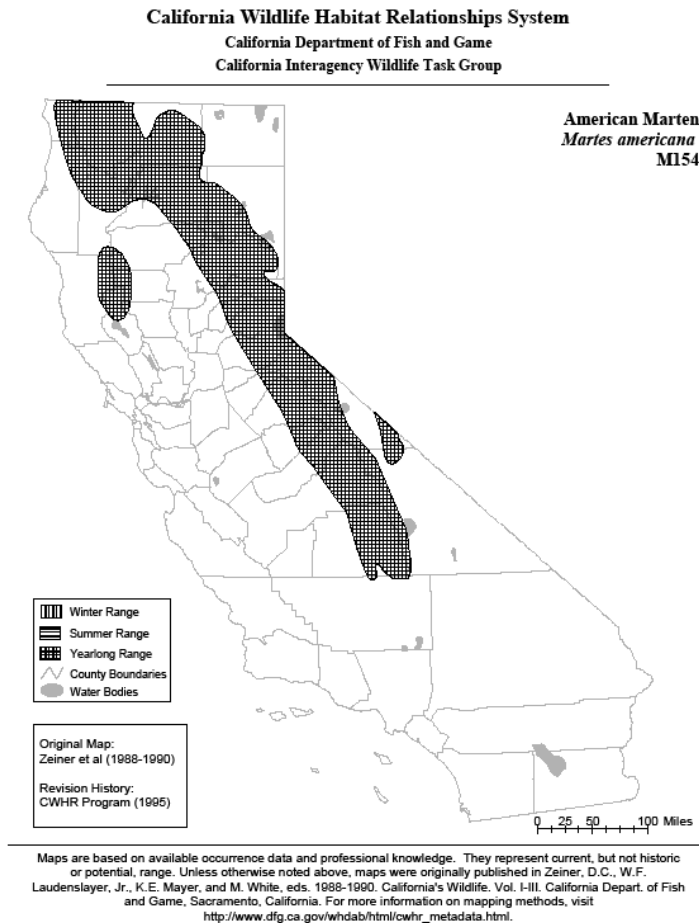


Figure AMMA-I-2. Distribution of American marten in California (CDFG 2005).

AMMA-I.A. General Suitable Habitat.

Optimal habitats are various mixed evergreen forests with more than 40% crown closure, with large trees and snags, especially within red fir, lodgepole pine, subalpine conifer, mixed conifer, Jeffrey pine, and eastside pine (CDFG 2005). Martens prefer coniferous forest habitat with large diameter trees and snags, large down logs, moderate-to-high canopy closure, and an interspersed of riparian areas and meadows. Important habitat attributes are: vegetative diversity, with predominately mature forest; snags; dispersal cover; and large woody debris (Allen 1982). Key components for westside and eastside marten habitat can be found in the Sierra Nevada Forest Plan Amendment FEIS (USDA Forest Service 2001), Volume 3, Chapter 3, part 4.4, pages 20-21.

Marten home ranges are very large relative to their body size by mammalian standards. Overall mean home ranges in California are 1,505 acres for males and 737 acres for females (SNFPA 2001). Mean home ranges for marten in the southern Sierra Nevada are 807 acres for males and 254 acres for females (SNFPA 2001). In the central Sierra Nevada, mean home ranges are 960 acres for males and 801 acres for females (Ibid). In

the eastern Sierra Nevada (Inyo and Humboldt-Toiyabe NFs), male home ranges average 2,749 acres and female home ranges average 1,155 acres (Ibid).

AMMA-I.B. Food Habits.

The marten diet in the Sierra Nevada changes seasonally but is predominately microtine rodents, tree squirrels (*Tamiasciurus douglasii* and *Glaucomys sabrinus*), snowshoe hares (*Lepus americanus*) and, especially in the summer, ground squirrels (*Eutamias* sp. and *Spermophilus lateralis*) (Zielinski et al. 1983, Martin 1987).

AMMA-I.C. Reproductive Habits.

Martens breed in summer and have delayed implantation (NatureServe 2007). A litter of 1-5 is born in spring in a den typically within cavities in large trees, snags, stumps, logs, burrows, caves, rocks, or crevices in rocky areas (CDFG 2005).

AMMA-I.D. Risks and Management Concerns.

Marten are sensitive to human disturbance, and trapped easily (CWHR 2005). Decreases in habitat quality and quantity can occur from activities that cause the removal of overhead forest cover, removal of large diameter trees and coarse woody debris, and the conversion of mesic to xeric sites with associated changes in prey communities (CWHR 2005, NatureServe 2007). Three factors make martens vulnerable to local extirpation and extinction: (1) low reproductive potential; (2) an affinity for overhead cover and avoidance of extensive open areas, especially in winter; and (3) very large home ranges (SNFPA 2001).

AMMA-II. Habitat Relationships

The American marten was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

AMMA-III. Habitat Status and Trend.

Currently, there are 1,006,923 acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada (1,195,595 acres on all ownerships). The trend is slightly increasing: over the last two decades, late seral closed canopy coniferous forest habitat changed from comprising 7% of the National Forest System land acres in the Sierra Nevada to 9%; since the early 2000s, the trend has been stable at 9%. See the Habitat Monitoring Section of this Report for more detailed information.

AMMA-IV. Population Status and Trend.***AMMA Current population status and trend – Sierra Nevada***

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007a). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

American marten has been monitored throughout the Sierra Nevada as part of general surveys and studies from 1996-2002 (Zielinski et al. 2005). Since 2002, the American marten has been monitored on the Sierra Nevada forests as part of the Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan (USDA Forest Service 2005, 2006, 2007b, 2009, 2010).

Zielinski et al. (2005) compared historical and contemporary distributions of American marten and nine other taxa of mesocarnivores by contrasting the distribution of museum and fur harvest records from the early 1900s with the distribution of detections from baited track-plate and camera surveys conducted in the Sierra Nevada from 1996 to 2002. They concluded that, the distribution of martens has become fragmented in the southern Cascades and northern Sierra Nevada, particularly in Plumas County. They further concluded that, based on their data as well as results of previous surveys at slightly higher elevations (Kucera et al. 1995), the distribution of martens appears to be continuous across high-elevation forests from Placer County south through the southern end of the Sierra Nevada (Zielinski et al. 2005).

Moriarty (2009) found that the distribution and detection rate of martens in the Sagehen Creek Experimental Forest (Tahoe NF) have declined in the past 28 years (between the 1908s and 2007/2008); the 2007/2008 average detection rate was 4% whereas the average detection rate in the 1980s was 65%.

SNFPA Fisher and Marten Status and Trend Monitoring began in 2002; this population monitoring involves conducting presence/absence surveys throughout the Sierra Nevada to estimate the proportion of sites (“primary sample units”) annually occupied by fisher and marten (USDA Forest Service 2007b). Habitat monitoring also occurs using a combination of remotely-sensed vegetation data and plot data collected in conjunction with the Forest Inventory and Analysis (FIA) plots that are co-located with the primary sample units. The sampling effort has been greater in the southern Sierra Nevada to meet the objectives of the higher-priority fisher population monitoring program. Marten seem to be distributed throughout their historic range (USDA Forest Service 2005, 2007b). During the 2007 and 2008 field seasons, sampling was limited to the southern Sierra Nevada, with an emphasis on sampling a somewhat reduced elevation range where fishers are most widely distributed, but where marten are likely less abundant (USDA Forest Service 2009, 2010).

Between 2002 and 2005, the SNFPA Fisher and Marten Status and Trend Monitoring completed surveys of 708 primary sample units, 510 on the Sequoia and Sierra National Forests and 198 in central and northern Sierra Nevada (USDA Forest Service 2006). Marten were detected at 84 sites. Detection rates across the years are summarized in Table AMMA-IV-1. Note that the decrease in detection rates for 2005 probably reflects the sampling emphasis for lower elevation fisher habitats (USDA Forest Service 2006).

In 2007, the detection rate results for 2002 to 2006 were re-assessed based on the reduced elevation sampled within the southern Sierra Nevada (Sequoia NF, Sierra NF, and southern Stanislaus NF) (USDA Forest Service 2009). These detection rates across years for the southern Sierra Nevada are summarized in Table AMMA-IV-2.

Table AMMA-IV-1. Proportion of Primary Sample Units with marten detections (USDA Forest Service 2006).

Year	Proportion of Sample Units with marten detections (# of sites with detection / number of sites surveyed)
2002	0.176
2003	0.167
2004	0.144
2005	0.084

Table AMMA-IV-2. Proportion of southern Sierra Nevada (Sequoia, Sierra, and southern Stanislaus NFs) Primary Sample Units with marten detections (USDA Forest Service 2009, 2010).

Year	Proportion of Sample Units with marten detections (# of sites with detection / number of sites surveyed)
2002	0.130
2003	0.054
2004	0.104
2005	0.096
2006	0.125
2007	0.108
2008	0.108

AMMA Current population status and trend - California

AMMA California Conservation Status. The California Natural Diversity Database (CNDDB) rank is “G5S3S4”: Global 5 indicates marten is globally “demonstrably secure; commonly found throughout its historic range”; State 3 / State 4 indicates that, in California, marten is between being ‘apparently secure’(G4) and ‘restricted range/rare’(G3); G4 indicates that there are some factors to cause some concern, such as narrow habitat or continuing threats; G3 indicates the species has about 21-80 viable occurrences or 1,000-3,000 individuals or 10,000 to 50,000 acres of occupied habitat within the State) (NatureServe 2007).

AMMA California Population Status. Based on track plate and camera data collected in California between 1989 and 1995, Kucera et al. (1995) concluded that marten appeared to occupy much of its historic range in California, particularly in the Sierra Nevada and south of the Trinity Mountains, but noted gaps in the distribution in Del Norte and Humboldt counties. They also noted negative survey results at numerous locations in central Plumas and southern Tulare counties (Ibid). Moriarty (2009) found that the distribution and detection rate of martens in the Sagehen Creek Experimental Forest (Tahoe NF) have declined in the past 28 years (between the 1908s and 2007/2008).

AMMA Current population status and trend – Range-wide

AMMA Range-wide Conservation Status. The Global conservation status of marten is “G5-Secure” (“demonstrably widespread, abundant, and secure”) and the United States National conservation status is “N5” (“secure – common, widespread, and abundant in the nation) (NatureServe 2007).

AMMA Range-wide Population Trend Index. The Global Short-Term Trend for marten is Stable (unchanged or within plus or minus 10% fluctuation in population, range, area occupied, and/or number or condition of occurrences) (NatureServe 2007).

AMMA-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that, although marten appear to be distributed throughout their historic range, their distribution has become fragmented in the southern Cascades and northern Sierra Nevada, particularly in Plumas County. The distribution appears to be continuous across high-elevation forests from Placer County south through the southern end of the Sierra Nevada, although detection rates have decreased in at least some localized areas (e.g., Sagehen basin area of Nevada County).

AMMA - References Cited

Allen, A. W. 1982. Habitat suitability index models: Marten. United States Fish and Wildlife Service, FWS/OBS-82/10.11, Fort Collins, CO, USA.

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version.
<http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Kucera, T.E., W.L. Zielinski, and R.H. Barrett. 1995. The current distribution of American martens (*Martes americana*) in California. *California Fish and Game* 81:96-103.

Martin, S.K. 1987. Ecology of the pine marten (*Martes americana*) at Sagehen Creek, California. Berkeley, CA: University of California. Ph.D. Dissertatation. 223pp.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

Moriarty, K.M. 2009. American Marten Distributions over a 28 Year Period: Relationships with Landscape Change in Sagehen Creek Experimental Forest, California, USA. Thesis for Master of Science, Oregon State University; Presented August 19, 2009, Commencement June 2010. 108pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available
<http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Patterson, B.D., G. Ceballos, W. Sechrest, M.F. Tognelli, T. Brooks, L. Luna, P. Ortega, I. Salazar, and B.E. Young. 2003. Digital Distribution Maps of the Mammals of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Bruce Patterson, Wes Sechrest, Marcelo Tognelli, Gerardo Ceballos, The Nature Conservancy-Migratory Bird Program, Conservation International-CABS, World Wildlife Fund-US, and Environment Canada-WILDSpace."

Simon, T. L. 1980. An ecological study of the marten in the Tahoe National Forest, California. M.S. Thesis, Sacramento State Univ. 187pp.

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. January 2001.

USDA Forest Service. 2005. Sierra Nevada forest plan accomplishment monitoring report for 2004. USDA Forest Service, Pacific Southwest Region R5-MR-026. 8pp.

USDA Forest Service. 2006. Sierra Nevada forest plan accomplishment monitoring report for 2005. USDA Forest Service, Pacific Southwest Region R5-MR-036. 12pp.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA Forest Service. 2009. Sierra Nevada forest plan accomplishment monitoring report for 2007. USDA Forest Service, Pacific Southwest Region. On-line version. <http://www.fs.fed.us/r5/snfpa/monitoringreport2007/>

USDA Forest Service. 2010. Sierra Nevada forest plan accomplishment monitoring report for 2008. USDA Forest Service, Pacific Southwest Region. On-line version. <http://www.fs.fed.us/r5/snfpa/monitoringreport2008/>

USDA Forest Service. 2007b. Sierra Nevada forest plan accomplishment monitoring report for 2006. USDA Forest Service, Pacific Southwest Region R5-MR-149. 12pp.

Zielinski, W.J., W.D. Spencer, and R.D. Barrett. 1983. Relationship between food habits and activity patterns of pine martens. *Journal of Mammalogy* 64:387-396.

Zielinski W.J., Kucera, T.E. (Eds). 1995. *American Marten, Fisher, Lynx, and Wolverine: Survey Methods for their Detection*. USDA Forest Service, Pacific Southwest Research Station, General Technology Report PSW-GTR-157.

Zielinski, W.J., R.L. Truex, F.V.Schlexer, L.A. Campbell, C.Carroll. 2005. Historical and contemporary distributions of carnivores in forests of the Sierra Nevada, California, USA. *Journal of Biogeography* 32:1385-1407.

Aquatic (Benthic) Macroinvertebrates (BMI)

BMI-I. Overview of MIS.

Aquatic (benthic) or bottom-dwelling macroinvertebrates (BMI) is the Management Indicator Species (MIS) for riverine and lacustrine habitat on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007).

BMI are appropriate as aquatic Management Indicator Species because they are sensitive to changes in water quality (Hawkins et al. 2000a, 2000b; Ode et al. 2005; Rehn 2009). Aquatic factors of particular importance that determine the composition of aquatic communities are magnitude and timing of flow, substrate size and composition, water chemistry and temperature, bank stability, and riparian conditions. Standard operating procedures from the States' Surface Water Ambient Monitoring Program (SWAMP) were employed. The Forest Service also accepted the State's recommendation to generate robust data sets by collecting stream algae to supplement the macroinvertebrate data with another indicator. This effort will enhance collaboration with SWAMP and provide baseline data that will be indispensable for defining reference conditions for stream and river algal communities.

The objective of the aquatic Management Indicator Species monitoring plan is to assess the biological water quality of streams, rivers and lakes in the Sierra Nevada national forests, and reach statistically valid conclusions about the overall quality of water resources on those forests. To reach such conclusions over a geographically broad area covering more than 10 million acres, requires application of a design based on probabilistic sampling, which is employed in this monitoring plan. Examples of how such monitoring plans have been applied are provided by the State of California's Clean Water Act 305(b) Report (SWAMP 2006) assessing the state of the States waters and EPA EMAP's stream monitoring across the nation (EPA 2006).

BMI-II. Habitat Relationships.

Benthic macroinvertebrates were selected as the MIS for riverine and lacustrine habitat in the Sierra Nevada. BMI have been demonstrated to be very useful as indicators of water quality and aquatic habitat condition (Resh and Price 1984; Karr et al. 1986; Hughes and Larsen 1987; Resh and Rosenberg 1989; Rehn et al. (2007). They are sensitive to changes in water chemistry, temperature, and physical habitat; factors of particular importance are flow, sedimentation, and water surface shade. Aquatic factors of particular importance are: pH; dissolved oxygen; wetted width; flow; sedimentation; chemical water quality; bank stability; and water surface shade.

BMI-III and BMI-IV. Index of Biological Integrity and Habitat Status and Trend.

Habitat condition and trend are measured by collecting aquatic macroinvertebrates, and analyzing the resulting data using the River Invertebrate Prediction and Classification

System (RIVPACS) (Hawkins 2003) to determine if the macroinvertebrate community has been impaired relative to reference condition. In addition, some of the stream habitat attributes included in the R5 Stream Condition Inventory (SCI, Frazier et al. 2005) are measured.

The amount of riverine and lacustrine habitat has not changed across the Sierra Nevada. Habitat status for RIVPACS sites was assessed by summarizing Stream Condition Inventory (SCI) data collected since 1994 (Frazier et al. 2005). The data set includes at least 300 sample sites for randomly sampled streams and lakes in the Sierra Nevada bioregion.

Moyle (1996) recognized 66 aquatic habitat types in the Sierra Nevada Province based on regions of native fish populations, flowing versus standing waters, and flow duration. He also evaluated the status of habitat types based on their rarity, level of human disturbance, and existing protection. Eighteen (27 percent) aquatic habitats in the Sierra are considered secure because they are common, widely distributed, concentrated at high elevations or in national parks. The secure group of habitats includes mountain lakes, streams, and pools. Half of the aquatic habitat types are of special concern because of declining abundance and quality or because of associated declining populations of native fishes. Many special habitats, such as springs and fens, are in this category. Fifteen types are threatened because they are declining rapidly and, in extreme cases, at risk of disappearing. Most threatened habitats are in lowland areas where human impacts have been most severe, such as the Owens and Central Valley, or have limited distributions with endemic fauna, such as Lake Tahoe, Eagle Lake, and Mono Lake. Moyle and Randall (1996) developed a watershed index of biotic integrity (IBI) based on distributions and abundance of native fish and amphibian species, as well as extent of roads and water diversions. According to this analysis, seven percent of the watersheds were in excellent condition, 36 percent were in good condition, 47 percent were in fair condition and nine percent were in poor condition.

Sierra Nevada MIS monitoring for BMI was conducted in 2009 and 2010 (Furnish 2010). Benthic macroinvertebrates were collected from stream sites during both the 2009 and 2010 field seasons according to the Reachwide Benthos (Multihabitat) Procedure (Ode 2007).

During both 2009 and 2010, 13 streams were sampled for macroinvertebrates and algae (Figure BMI-1a). During both years, contractors were able to visit most sites, but sampling success was very limited for a variety of reasons. For example, of the 54 stream and lakes sites visited by contractors during 2009, 20 were assessed, 19 were inaccessible due to high water, rugged terrain or excessive distance, seven were dry, four were on private property, three lakes sites were deemed reservoirs and therefore unrepresentative of natural lake conditions, and one site had been recently burned. Severe drought conditions during 2009 resulted in many problems finding appropriate perennial sites even after a thorough map reconnaissance and consultation with forest specialists to establish whether a site was actually perennial and accessible. Four of the stream sites were collected as annual sites, meaning that they were sampled both years to examine

annual variability of the benthic community. During 2009 and 2010, seven and nine lakes were sampled, respectively. Six lake sites were sampled during both 2009 and 2010 to allow an assessment of annual variability.

In addition, to account for possible impacts from global climate change to stream dynamics and aquatic MIS, additional BMI work related to climate change began through a partnership with Dr. David Herbst of UC Santa Barbara.

Stream and River Results. Approximately 165 invertebrate taxa were collected from the 13 sites. Mean taxa richness per site was 40, but varied widely from 9 (Greenhorn Creek, Tahoe National Forest) to 61 (Hungry Creek, Plumas National Forest). Although a multimetric Index of Biotic Integrity (IBI) has not yet been published for the Sierra Nevada Province, several more geographically restricted IBIs have been developed and five metrics that were found to show consistent dose responses to land management activities were selected to analyze stream condition (Fore 2007, Rehn 2009, Herbst and Sildorff 2009). The five metrics chosen and the values necessary to achieve a maximum score of 10 were: 1) number of stonefly taxa (at least 12), 2) number of caddisfly taxa (at least 15), 3) percent intolerant taxa (at least 42%), 4) number of tolerant taxa (0), and 5) percent non-insect taxa (no more than 11%). Assuming a threshold for biological impairment to be less than 57% of the total possible IBI score (SWAMP 2006), seven sites had very good water quality (i.e. were comparable to reference or unimpaired conditions), and six sites were found to be impaired for biological water quality (Table BMI-1, Figure BMI-1b).

Stream algae samples taken during 2009 and 2010. Following the standard SWAMP protocols, a total of 600 diatom valves were counted for each sample. The current SWAMP protocol for sampling stream algae includes methods for both diatoms and soft-bodied algae. Both algal types were collected during 2009. However, only diatom samples were collected during 2010 because of unreconciled issues over replicability of the soft-bodied algae protocol, and concerns about safety regarding the handling of gluteraldehyde, which is a highly toxic preservative. Thus far, about 220 algae taxa have been collected. Some diatom taxa appear to be ubiquitous and have occurred at every site (e.g., *Encyonema silesiacum*, *Synedra ulna*, and pennate diatoms).

Lake Results. Approximately 53 invertebrate taxa were identified from collections at the seven lake sites collected during 2009. Mean taxa richness was 17; richness varied from 9 (Gilmore Lake, Tahoe National Forest) to 24 (Clear Lake, Modoc National Forest). Mean density of macroinvertebrates was 583/ m², with a range from 50 to 2100/m². At present there are no accepted methods for evaluating lake condition based upon benthic macroinvertebrates alone so further conclusions are not yet possible.

Table BMI-1. IBI site condition scores for the 13 streams sampled for aquatic MIS during 2009. The threshold for impairment was set at 57% of total possible score based on the California 305(b) report (SWAMP 2006).

Sierra Nevada Stream Name	National Forest	IBI Score (Out	Biological
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		of 50 Possible)	Assessment
Turner Creek	Modoc	12	Impaired
Little Last Chance Creek	Plumas	14	Impaired
South Fork Kern River	Sequoia	20	Impaired
Greenhorn Creek	Tahoe	25	Impaired
North Fork Tuolumne River (S019)	Stanislaus	27	Impaired
Mono Creek	Sierra	28	Impaired
Pass Creek	Tahoe	30	Non-impaired
N. Fk of Mid. Fk of American River	Tahoe	30	Non-impaired
North Fork Tuolumne River (SA003)	Stanislaus	33	Non-impaired
Onion Creek	Tahoe	35	Non-impaired
Hungry Creek	Plumas	38	Non-impaired
Carter Creek	Lassen	39	Non-impaired
Forest Creek	Stanislaus	42	Non-impaired

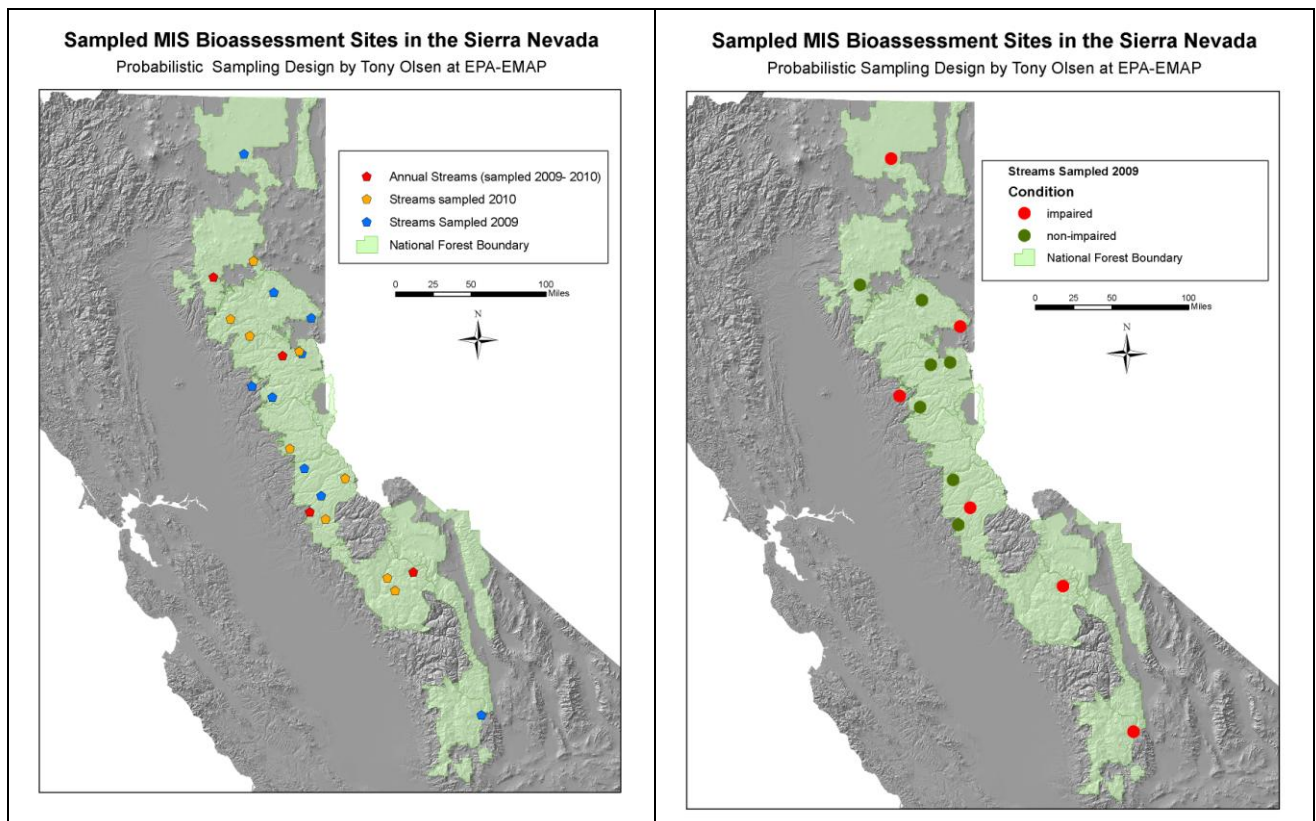


Figure BMI-1a (above left). The distribution of streams sampled during 2009-10 for aquatic MIS.

Figure BMI-1b (above right). The condition of the aquatic MIS communities sampled during 2009 based upon scores derived from an Index of Biotic Integrity.

Global Climate Change Results. Dr. Herbst and colleagues at U.C. Santa Barbara have conducted a GIS-based analysis of the susceptibility of 165 watersheds to impacts of global climate change based upon attributes like the degree to which flow is dependent on snowpack vs. groundwater. This analysis resulted in the selection of 12 sentinel watersheds representing extremes in projected percent loss of runoff (range of 5 to 65%) and baseflow (0 to 31%). These sentinel watersheds range in size from 6,200 to 42,800 acres (25-173 km²). As a working hypothesis, the biological communities of streams projected to suffer the lowest losses in runoff and baseflow will change less than those projected to suffer the highest losses in water yield. Based upon broad-scale macroinvertebrate collections, optimal temperatures for specific taxa are becoming available, making these evaluations possible. During 2009, the GIS analysis of watershed susceptibility was completed. During 2010, all 12 sentinel watersheds were instrumented with 30 minute interval temperature probes and pressure transducers to monitor air and water temperatures, as well as the timing and magnitude of the flow regime. Macroinvertebrates, water chemistry and physical habitat was also assessed using standard SWAMP protocols, but results are not yet available.

BMI-V. Population Status and Trend Summary for the Sierra Nevada National Forests.

Current data from the Sierra Nevada indicate that status and trend in the RIVPACS scores appears to be stable; initial BMI data from 2009 and 2010 found 46% (6 of 13) of the surveyed streams indicate an impaired condition and 54% (7 of 13) indicate a non-impaired condition, similar to the IBI conditions estimated by Moyle and Randall (1996).

BMI References Cited

EPA. 2006. Wadeable Streams Assessment: A Collaborative Survey of the Nation's Streams, Office of Research and Development, Office of Water Washington, DC 20460; EPA 841-B-06-002.

Fore, L. S. 2007. Development and testing of biomonitoring tools for stream macroinvertebrates in the Lake Tahoe Basin. Unpublished report to the USFS-Lake Tahoe Basin Management Unit.

Frazier J.W., K.B. Roby, J.A. Boberg, K. Kenfield, J.B. Reiner, D.L. Azuma, J.L. Furnish, B.P. Staab, S.L. Grant. 2005. Stream Condition Inventory Technical Guide. USDA Forest Service, Pacific Southwest Region - Ecosystem Conservation Staff. Vallejo, CA. 111 pp.

Furnish, J. 2010. Progress report on monitoring of aquatic management indicator species (MIS) in the Sierra Nevada Province: 2009-2010 Field Seasons. December 2010. 6pp.

Hawkins, C.P. 2003. Development, evaluation, and application of a RIVPACS-type predictive model for assessing the biological condition of streams in Region 5

(California) national forests. Completion Report. Western center for Monitoring and Assessment of Fresh Water Ecosystems. Utah State University. Logan, Utah 23 pp.

Hawkins, C.P., R.H. Norris, J.N. Hogue and J.W. Feminella. 2000a. Development and evaluation of predictive models for measuring the biological integrity of streams. *Ecological Applications* 10:1456-1477.

Hawkins, C.P., R.H. Norris, J. Gerritsen, R.M. Hughes, S.K. Jackson, R.K. Johnson, R.J. Stevenson. 2000b. Evaluation of the use of landscape classifications for the prediction of freshwater biota synthesis and recommendations. *Journal of the North American Benthological Society* 19:541-556.

Herbst, D. B. and E. L. Silldorff. 2009. Development of a benthic macroinvertebrate index of biological integrity (IBI) for stream assessments in the eastern Sierra Nevada of California. SWAMP Final Technical Report.

Hughes, R.M. and D.P. Larsen. 1987. Ecoregions: an approach to surface water protection. *Journal of the Water Pollution Control Federation* 60:486-493.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. *Illinois Natural History Survey Special Publication* 5, Champaign, IL.

Moyle, P.B. 1996. Status of aquatic habitat types. Pages 945-952 In *Sierra Nevada Ecosystem Project, Final Report to Congress, Vol. II, Assessments and scientific basis for management options*. University of California, Centers for Water and Wildland Resources, Davis. CA. 95616.

Moyle, P.B. and P.J. Randall. 1996. Biotic Integrity of Watersheds. Pages 975-985 in *Sierra Nevada Ecosystem Project: Final Report to Congress, Assessments and scientific basis for management options*, Vol II, chp 34. University of California, Centers for Water and Wildland Resources, Davis, CA 95616.

Ode, P.R., A.C. Rehn and J.T. May. 2005. A quantitative tool for assessing the integrity of southern coastal California streams. *Environmental Management* 35:493-504.

Ode, P.R. 2007. Standard operating procedure for collecting macroinvertebrate samples and associated physical and chemical data for ambient bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001.

Rehn, A.C. 2009. Benthic macroinvertebrates as indicators of biological condition below hydropower dams on west slope Sierra Nevada streams, California, USA. *River Research and Applications* 25:208-228.

Rehn, A.C., P.R. Ode and C.P. Hawkins. 2007. Comparisons of targeted-riffle and reach-wide benthic macroinvertebrate samples: implications for data sharing in stream-condition assessments. *Journal of the North American Benthological Society*. 26

Resh, V.H. and D.G. Price. 1984. Sequential sampling: a cost-effective approach for monitoring benthic macroinvertebrates in environmental impact assessments. *Environmental Management* 8:75-80.

Resh, V.H. and D.M. Rosenberg. 1989. Spatial-temporal variability and the study of aquatic insects. *Canadian Entomologist* 121:941-963.

SWAMP (Surface Water Ambient Monitoring Program). 2006. Water Quality Assessment of the Condition of California Coastal Waters and Wadeable Streams. The Clean Water Act 305(b) Report to the Environmental Protection Agency.

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

Black-backed Woodpecker (*Picoides arcticus*) (BLWO)

BLWO-I. Overview of Species.

The Black-backed Woodpecker (*Picoides arcticus*) is the Management Indicator Species (MIS) for the ecosystem component snags within burned forest on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007a).

This species occurs from western and central Alaska to northern Saskatchewan and central Labrador, south to southeastern British Columbia, central California, northwestern Wyoming, southwestern South Dakota, central Saskatchewan, northern Minnesota, southeastern Ontario, and northern New England (NatureServe 2007) (Figure BLWO-I-1). In California, the black-backed woodpecker occurs from the Siskiyou Mountains, Mount Shasta, and Warner Mountains south through the Cascade Range and the Sierra Nevada to Tulare County (CDFG 2005) (Figure BLWO-I-2).

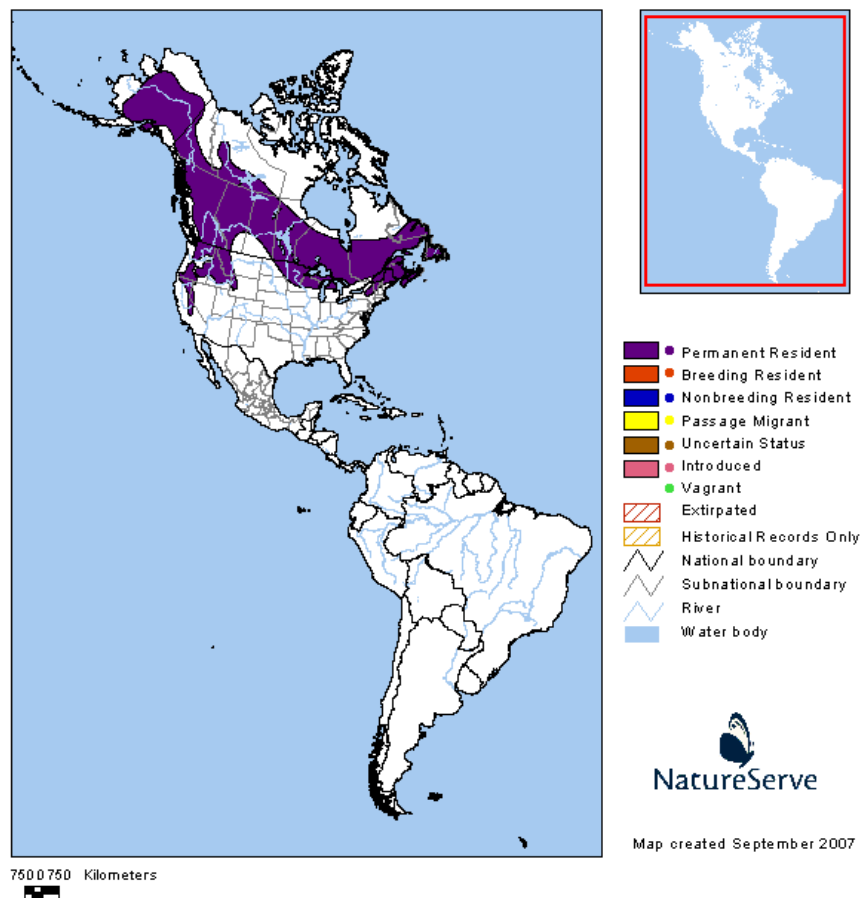


Figure BLWO-I-1. Range-wide distribution of Black-backed woodpecker (Ridgely et al. 2003 in NatureServe 2007).

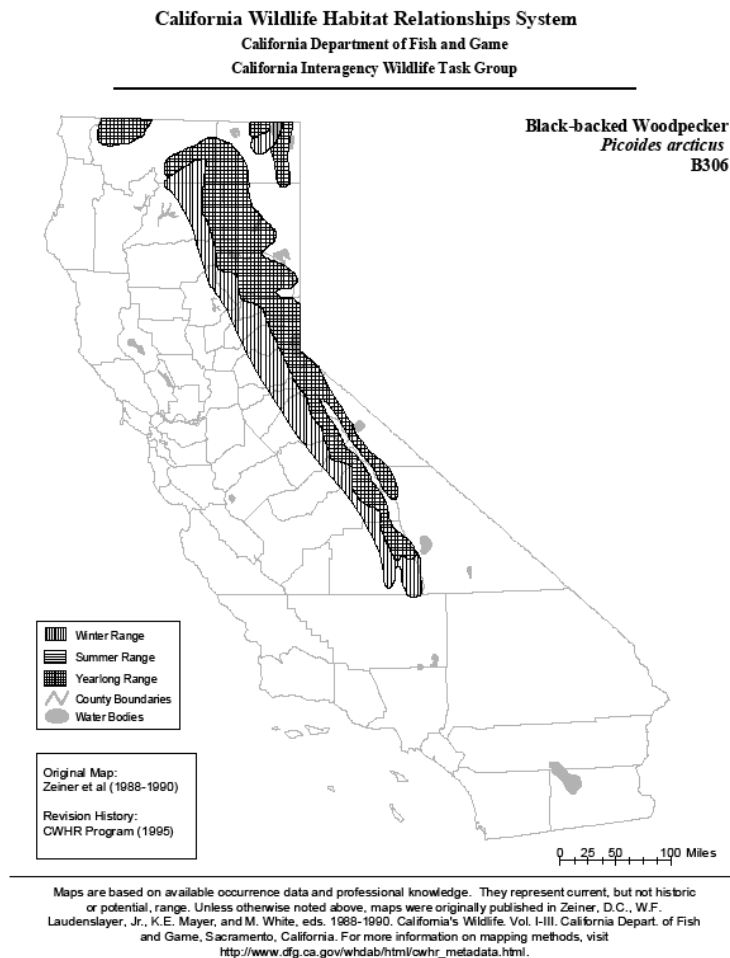


Figure BLWO-I-2. Distribution of black-backed woodpecker in California (CDFG 2005).

BLWO-I.A. General Suitable Habitat. Recent data indicate that black-backed woodpeckers are dependent on snags recently created by stand-replacement fires (Hutto 2005, Kotliar et al. 2002, Smucker et al. 2005). The abundant snags associated with severely burned forests provide both prey (by providing food for the specialized beetle larvae that serve as prey) and nesting sites (Hutto and Gallo 2006). Black-backed woodpeckers have been found to rapidly colonize stand-replacing burns, within one to two years of a fire, but become rare in the burned area within five years (Kotliar et al. 2002).

Densities of black-backed woodpeckers in the Sierra Nevada were estimated at 0.2 pairs per 40 hectares (Raphael and White 1984 in NatureServe 2007) and from 3.2 pairs per 40 hectares in burned forest to 0.5 pairs per 40 hectares in unburned forest (Bock and Lynch 1970 in Dixon and Saab 2000). Reported home range sizes include: 72-328, median 124, hectares (n=3, Oregon, Goggans et al. 1988 in NatureServe 2007); 72 hectares (n=1,

Idaho, Dixon and Saab 2000); and 61 hectares (Vermont, Lisi 1988 in NatureServe 2007). Territory size in northeastern and north-central forests was estimated at 30 hectares, with a maximum density of 3.3 pairs per 100 hectares (Evans and Conner 1979 in NatureServe 2007).

BLWO-I.B. Food Habits. The black-backed woodpecker feeds on larval and adult insects, primarily wood-boring beetles, obtained by foraging under bark or by drilling into the conifer trunks of snags or dying or insect-infested trees (CDFG 2005).

BLWO-I.C. Reproductive Habits. This species usually lays 2-6 eggs in a cavity excavated within a conifer snag, usually mid-May to mid-June. Reported mean diameter of nest trees include: 27cm (n=15, NW Wyoming, Hoffman 1997 in Dixon and Saab 2000); 30 cm dbh (n=10, n. Montana, Hutto and Gallo 2006); 37cm (n=15, NE Oregon, Bull et al. 1986 in Dixon and Saab 2000); 39cm (n=35, SW Idaho, Dixon and Saab 2000); 40cm (n=11, NW Montana, Caton 1996 in Dixon and Saab 2000). Reported mean heights of nest trees include: 17m (n=10, N. Montana, Hutto and Gallo 2006); 19m (n=15, NE Oregon, Bull et al. 1986 in Dixon and Saab 2000); 21.7m (n=35, SW Idaho, Dixon and Saab 2000); 28m (n=11, NW Montana, Caton 1996 in Dixon and Saab 2000); and 23.7m (n=15, NW Wyoming, Hoffman 1997 in Dixon and Saab 2000).

BLWO-I.D. Risks and Management Concerns. This species is at risk from timber harvest, fire suppression, removal of fire-killed or insect-infested trees, and the conversion of mature and old-growth forests to young stands with few decayed trees (NatureServe 2007).

BLWO-II. Habitat Relationships

The black-backed woodpecker was selected as the MIS for the ecosystem component of snags in burned forests.

BLWO-III. Habitat Status and Trend.

The current average number of medium-sized and large-sized snags (> 15" dbh, all decay classes) per acre across major coniferous and hardwood forest types (westside mixed conifer, ponderosa pine, white fir, productive hardwoods, red fir, eastside pine) in the Sierra Nevada ranges from 1.5 per acre in eastside pine to 9.1 per acre in white fir. In 2008, snags in these types ranged from 1.4 per acre in eastside pine to 8.3 per acre in white fir (USDA Forest Service 2008).

Data from the early-to-mid 2000s were compared with the current data to calculate the trend in total snags per acre by Regional forest type for the 10 Sierra Nevada national forests and indicate that, during this period, snags per acre increased within westside mixed conifer (+0.16), white fir (+2.66), productive hardwoods (+0.35), and red fir (+1.25) and decreased within ponderosa pine (-0.17) and eastside pine (-0.14).

These data include snags in both green forest and burned forest. Between 2000 and 2007, 211,000 acres underwent severe burn and 176,000 acres underwent moderate burn in the Sierra Nevada. Detailed information can be found in the Habitat Monitoring Section of this Report.

Additionally, the sampling frame used for the population status and trend monitoring consisted of 323,358 ha (799,035 acres) of 72 fires that occurred between 1999 and 2008, comprised at least 50 ha (124 acres) of conifer forest, that burned at mid-severity and/or high-severity, and that occurred at least partially on one or more of the ten national forest (Siegel et al. 2010).

BLWO-IV. Population Status and Trend.

BLWO Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007a). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

The Sierra Nevada MIS black-backed woodpecker monitoring effort began in 2008. This monitoring was conducted in partnership with the Institute for Bird Populations (IBP). The additional information, including the sampling protocol and the 2008 and 2009 reports, can be found at: <http://www.birdpop.org/Sierra/bbwo.htm>. The results are summarized below.

The following is a summary of the 2008 and 2009 field season results. For more detailed information, see the reports posted on the web:

2008 (the pilot year): Black-backed woodpeckers were detected at 68 survey stations distributed across ten of the 19 fire areas surveyed (Siegel et al. 2008). Occupied sites were well distributed across the Sierra Nevada national forests, and included both the second most northerly fire area (Straylor Fire on Lassen NF) and the most southerly fire area (Vista Fire on Sequoia NF) surveyed, as well as sites both west and east of the Sierra crest. Black-backed woodpeckers were detected in every major pre-fire WHR habitat type surveyed, including Eastside Pine, Jeffrey Pine, Jeffrey Pine/Red Fir, Sierra Mixed Conifer, and Subalpine Conifer. Occupied fire areas ranged from small (Vista Fire = 170 ha burned, Rock Creek Fire = 187 ha burned) to very large (Moonlight Fire = 26,159 ha burned). The fire areas surveyed ranged from 1 year post-fire to 7 years post-fire. Both of the 1-year post-fire sites were occupied by black-backed woodpecker, as were 2 of 3 two-year post-fire sites, 1 of 1 four-year post-fire sites, 2 of 3 five-year post-fire sites, 0 of 4 six-year post-fire sites, and 3 of 4 seven-year post-fire sites .

Of the 17 fire areas where playback surveys were conducted, black-backed woodpecker were detected at 5 of the 64 stations (7.8%) in stands classified as low-severity fire, 28 of the 163 stations in stands classified as mid-severity fire (17.2%), and 35 of the 139 stations (25.2%) in stands classified as high-severity fire. This association between

black-backed woodpecker detections and fire severity was statistically significant (chi-square = 7.45, $p < 0.05$), indicating the woodpeckers prefer, or perhaps are more detectable in areas of higher-severity fire.

2009: During the 2009 field season, passive and broadcast surveys were conducted at 899 survey stations arrayed across 51 recent fire areas (1-10 years post-fire) throughout the ten National Forests in the Sierra Nevada. In addition, habitat data were collected at each survey station. Black-backed woodpeckers were detected at 169 survey stations distributed across 28 of the 51 fire areas surveyed, including fire areas on nine of the ten national forests, on both the west and east sides of the Sierra crest, and across nearly the full latitudinal range of these National Forests.

Mean occupancy probability for stations surveyed during 2009 was 0.253 (95% credible interval: 0.222 – 0.289). Assuming that the sample was representative of habitat yielded by all fires in the study area that burned between 1999 and 2008 results in an estimate that approximately 81,814 ha (i.e., 25.3%) of the 323,358 ha of burned forest on the ten national forest units within monitoring area was occupied by black-backed woodpeckers in 2009 (or a range based on the 95% credible interval of 71,921 – 93,610 ha).

In addition, black-backed woodpeckers have been monitored and surveyed in the Sierra Nevada at various sample locations by avian point count, spot mapping, mist-net, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008).

BLWO Current population status and trend - California

BLWO California Conservation Status. The black-backed woodpecker is ranked as S3 – Vulnerable (vulnerable in the state because of rarity due to a restricted range, relatively few populations (often 80 or fewer), recent or widespread declines, or other factors making it vulnerable to extirpation).

BLWO California Population Trend Index. BBS trend for California from 1966-2005 is -0.4, range -0.0 to 8.1 ($p=0.93$, $N=7$); however, the data have a regional credibility ranking of red (data with an important deficiency) (Sauer et al. 2007). Based on BBS data from 1966 through 1996 for routes in the Sierra Nevada, Siegel and DeSante (1999) calculated the abundance of black-backed woodpecker on 4 routes to be 0.09 birds per route.

BLWO Current population status and trend – Range-wide

BLWO Range-wide Conservation Status. The Global conservation status of the black-backed woodpecker is G5-Secure (common, widespread, and abundant) and the National

conservation status is N4-Apparantly Secure (uncommon but not rare; some cause for long-term concern due to declines or other factor).

BLWO Range-wide Population Trend Index. BBS trend survey-wide from 1966-2006 is -0.8, range -3.8 to 2.2 ($p=0.60$, $N=84$); however, the data have a regional credibility ranking of red (data with an important deficiency).

BLWO-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of black-backed woodpecker populations in the Sierra Nevada is stable.

BLWO References Cited

Bock, C.E., and J.F. Lynch. 1970. Breeding Bird Populations of Burned and Unburned Conifer Forest in the Sierra Nevada. *The Condor* 72(2):182-189.

Burnett, R.D., D.L. Humple, T.Gardali, M.Rogner. 2005. Avian monitoring in Lassen National Forest, 2004 Annual Report. PRBO Conservation Science, Contribution Number 1242. 96pp.

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Dixon, Rita D., and Victoria A. Saab. 2000. Black-backed Woodpecker (*Picoides arcticus*), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/509>

Heath, S.K. 2005. Bird monitoring in montane meadow and riparian habitats of Devils Postpile National Monument. Final Report 2002-2004. PRBO Conservation Science, PRBO Contribution #1237.

Hutto, R.L. 1995. Composition of bird communities following stand-replacement fires in Northern Rocky Mountain (U.S.A.) conifer forests. *Conservation Biology* 9(5):1041-1058.

Hutto, R.L., and S.M. Gallo. 2006. The effects of postfire salvage logging on cavity-nesting birds. *The Condor* 108:817-831.

Kotliar, N.B., S.J. Hejl, R.L. Hutto, V.A. Saab, C.P. Melcher, and M.E. McFadzen. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the western United States. *Studies in Avian Biology* No.25:49-64.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Raphael, M.G. and M. White. 1984. Use of Snags by Cavity-Nesting Birds in the Sierra Nevada. *Wildlife Monographs* No. 86. 66pp.

Raphael, M.G., M.L. Morrison, M.P. Yoder-Williams. 1987. Breeding Bird Populations during Twenty-Five Years of Postfire Succession in the Sierra Nevada. *The Condor* 89(3):614-626.

Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2003. Digital Distribution Maps of the Birds of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSPACE."

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. USGS Patuxent Wildlife Research Center, Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight. Available on-line: <http://www.prbo.org/calpif/htmldocs/sierra.html>.

Siegel, R. B., R.L. Wilkerson, and D.L. Mauer. 2008. Black-backed Woodpecker (*Picoides arcticus*) Surveys on Sierra Nevada National Forests: 2008 Pilot Study. Final report in fulfillment of Forest Service Agreement No. 08-CS-11052005-201. September 30, 2008. The Institute for Bird Populations, P.O. Box 1346, Point Reyes Station, CA 94956. 80pp.
http://www.birdpop.org/DownloadDocuments/BBW_2008_Final_Report.pdf

Siegel, J.B., J.F. Saracco, and R. L. Wilkerson. 2010. Management Indicator Species (MIS) Surveys on Sierra Nevada National Forests: Black-backed Woodpecker 2009 Annual Report. A report in fulfillment of Forest Service Agreement No. 08-CS-11052005-201, Modification #1. April 27, 2010. The Institute for Bird Populations, P.O. Box 1346, Point Reyes Station, CA 9495666pp.
http://www.birdpop.org/DownloadDocuments/2009_MIS_report_for_BBWO.pdf

Smucker, K.M., R.L. Hutto, and B.M. Steele. 2005. Changes in bird abundance after wildfire: importance of fire severity and time since fire. *Ecological Applications* 15(5):1535-1549.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA Forest Service. 2007b. Lake Tahoe Basin Management Unit Multi Species Inventory and Monitoring: A Foundation for Comprehensive Biological Status and Trend Monitoring in the Lake Tahoe Basin. Draft Report.

Zack, S., T.L. George, W.F. Laudenslayer, Jr. 2002. Are there snags in the system? Comparing cavity use among nesting birds in “snag-rich” and “snag-poor” eastside pine forests. Pages 179-191 in *Ecology and Management of Dead Wood in Western Forests*, USDA Forest Service Gen. Tech. Rep. PSW-GTR-181.
http://www.fs.fed.us/psw/publications/documents/gtr-181/017_Zack.pdf.

California Spotted Owl (*Strix occidentalis occidentalis*) (CASPO)

CASPO-I. Overview of Species.

The California Spotted Owl (*Strix occidentalis occidentalis*) is a Management Indicator Species (MIS) for late seral closed canopy coniferous forest habitat on nine of the Sierra Nevada national forests (Eldorado, Inyo, Lassen, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007).

The California spotted owl occurs only in California, on the western side of the Sierra Nevada (and very locally on the eastern slope) from the vicinity of Burney, Shasta County south through the southern Cascade Range and Sierra Nevada to Kern County; in the southern part of the Coast Ranges from Monterey County to Santa Barbara County; and in the Transverse and Peninsular Ranges of southern California south to Baja California (Gutiérrez et al. 1995, Verner et al. 1992, USFWS 2003), with isolated in the Santa Cruz Mountains and Santa Lucia Mountains (Gould 1974, USFWS 2003) (Figure CASPO-I-1).

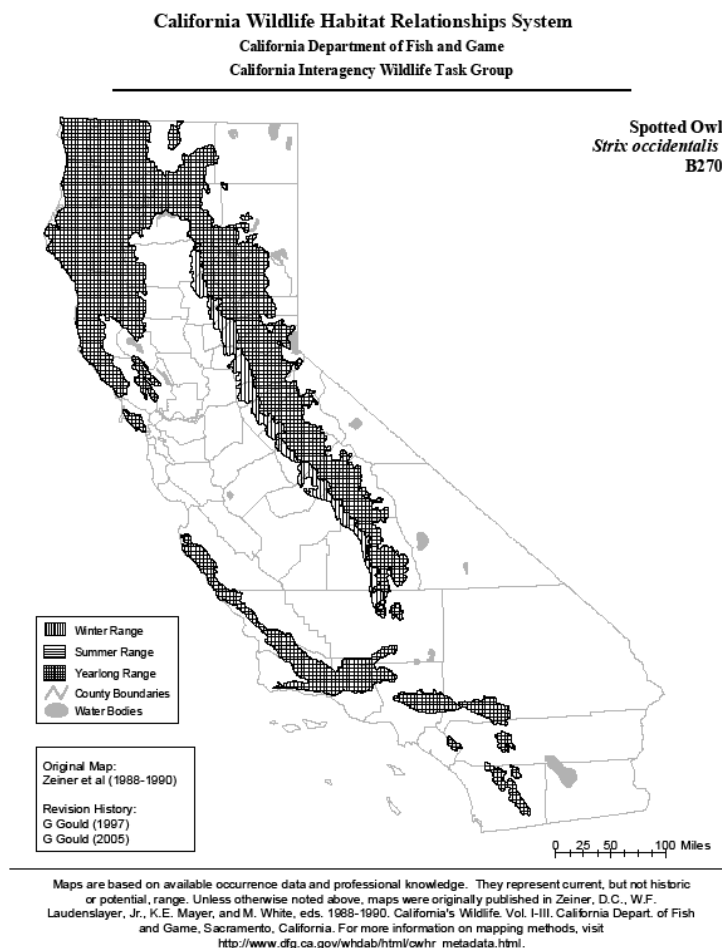


Figure CASPO-I-1. Distribution of the California spotted owl (CDFG 2005).

CASPO-I.A. General Suitable Habitat. The California spotted owl is strongly associated with forests that have a complex multi-layered structure, large-diameter trees, and high canopy closure (CDFG 2005, USFWS 2006). It uses dense, multi-layered canopy cover for roost seclusion; roost selection appears to be related closely to thermoregulatory needs, and the species appears to be intolerant of high temperatures (CWHR 2005). Mature, multi-layered forest stands are required for breeding (Ibid). The mixed-conifer forest type is the predominant type used by spotted owls in the Sierra Nevada: about 80 percent of known sites are found in mixed-conifer forest, with 10 percent in red fir forest (USDA Forest Service 2001).

Estimates of California spotted owl home range size are extremely variable. All available data indicate that home ranges are smallest in habitats at relatively low elevations that are dominated by hardwoods, intermediate in size in conifer forests in the central Sierra Nevada, and largest in the true fir forests in the northern Sierra Nevada (Verner et al. 1992, USDA Forest Service 2001). In order to manage spotted owl habitat across the Sierra Nevada, Home Range Core Areas (HRCAs) are established surrounding each territorial spotted owl activity center detected after 1986; HRCAs are the following sizes: 2,400 acres on the Hat Creek and Eagle Lake Ranger Districts of the Lassen NF, 600 acres on the Sequoia and Sierra NFs, and 1,000 acres on the Almanor Ranger District of the Lassen National Forest and the remaining national forests (USDA Forest Service 2004).

CASPO-I.B. Food Habits. This owl feeds in forest habitats upon a variety of small mammals, including flying squirrels, woodrats, mice and voles, and a few rabbits; it also eats small birds, bats, and large arthropods (CDFG 2005). In the Sierra Nevada, spotted owls above the mid-elevation conifer forests (about 4,000 to 5,000 feet) prey mainly on northern flying squirrels; owls in the mid- to lower elevations of the mixed conifer zone and the upper part of the ponderosa pine zone prey heavily on both northern flying squirrels and woodrats; and owls in the Sierra Nevada foothill riparian/hardwoods consume primarily woodrats (Verner et al. 1992).

CASPO-I.C. Reproductive Habits. Spotted owls nest in live trees and snags, with eggs placed in pre-existing structures such as cavities, broken top trees, and platforms (e.g., mistletoe brooms, debris platforms, and old raptor or squirrel nests) (USFWS 2003). Mature, multi-layered forest stands are required for breeding (Ibid). The breeding season of spotted owls extends from mid-February to mid-September or early October.

CASPO-I.D. Risks and Management Concerns. The following factors are affecting the California spotted owl: destruction or modification of habitat by wildfire, fuels-reduction activities, timber harvest, tree mortality, and development; however, the possible short-term effects from fuels-reduction activities are thought to be ameliorated by the longer-term reduction in the greater risk of catastrophic wildfire (USFWS 2006).

CASPO-II. Habitat Relationships

The California spotted owl was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

CASPO-III. Habitat Status and Trend.

Currently, there are 1,006,923 acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada (1,195,595 acres on all ownerships). The trend is slightly increasing: over the last two decades, late seral closed canopy coniferous forest habitat changed from comprising 7% of the National Forest System land acres in the Sierra Nevada to 9%; since the early 2000s, the trend has been stable at 9%. See the Habitat Monitoring Section of this Report for more detailed information.

CASPO-IV. Population Status and Trend.***CASPO Current population status and trend – Sierra Nevada***

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations. California spotted owl has been monitored in California and throughout the Sierra Nevada through general surveys, monitoring of nests and territorial birds, and on-going demography studies (Verner et al. 1992; Gutierrez et al. 2008, 2009, 2010; USDA Forest Service 2001, 2004; USFWS 2006; Sierra Nevada Research Center 2007, 2008, 2009, 2010; USDA Forest Service 2006).

CASPO Population Size and Distribution in the Sierra Nevada. As of 2002, a total of 2,306 California spotted owl territories had been documented throughout the range, 1,865 (81 percent) of which are in the Sierra Nevada and 1,399 on National Forests (USFWS 2003, 2006). The Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests have major populations of spotted owls, with 99 percent of the total known owl sites on National Forest System lands occurring within these forests; these seven National Forests include the vast majority of suitable habitat for spotted owls in the Sierra Nevada (USDA Forest Service 2001, 2004). Numbers of California spotted owls

are low on the Modoc, Inyo, and Humboldt-Toiyabe National Forests, and in the Lake Tahoe Basin Management Unit, and reproduction is infrequent (Ibid).

California spotted owls are currently distributed relatively continuously and uniformly throughout their range in the Sierra Nevada (Verner et al. 1992, USFWS 2003). In 2006, The US Fish and Wildlife Service determined that the best available data indicated that California spotted owl populations are stationary throughout the Sierra Nevada (USFWS 2006).

CASPO Population Trends in the Sierra Nevada. Five demographic studies of the California spotted owl have been ongoing for a number of years, four of which are in the Sierra Nevada (Table CASPO-IV-1). One of the primary objectives of these studies is to monitor fluctuations or rate of change (*lambda*) in owl populations. The most appropriate measure of the rate of change of spotted owl populations has been debated considerably (see USDA Forest Service 2001). Historically, spotted owl researchers have estimated the rate of change using a *Leslie projection matrix* that is based on estimates of age or stage-specific survival and fecundity, which was the best available at the time it was used for estimating rates of population change; using this method, the four Sierra Nevada studies reported statistically significant declining trends over the duration of each study based on estimates of *lambda* (Blakesley et al. 2001, Gutierrez et al. 1999, Steger et al. 1999). These estimates suggest rates of decline during the periods of study that range from 6 to 11 percent per year (USDA Forest Service 2001).

Nevertheless, a debate on rates of population change using *lambda* has centered on two issues: unknown rates of juvenile emigration from the study areas and potential bias in estimates of juvenile survival (Franklin et al. 2003). In 2001, the Pacific Southwest Research Station brought together a team of 16 scientists to develop and document results of a meta-analysis, using data gathered from five California spotted owl demographic studies, in an effort to assess population status and trends using a new approach (Franklin et al. 2003). Table CASPO-IV-1 compares the results of *lambda* utilizing the original projection-matrix and the capture-recapture methods (Franklin et al. 2003).

Table CASPO-IV-1. Comparison of Lambda (λ) from Projection Matrix and Capture-Recapture Methods (from USDA Forest Service 2004).

Study Area	Years	Projection Matrix			Capture-Recapture		
		λ	SE	95% CI	λ	SE	95% CI
Eldorado	1986-1998	0.930	-	-	1.042	0.047	0.950-1.133
Lassen	1990-1998	0.923	-	0.888-0.958	0.985	0.026	0.934-1.036
San Bernadino	1986-1998		-	-	0.978	0.025	0.929-1.026
Sierra	1987-1998	0.898	-	-	0.961	0.024	0.915-1.008
Sequoia/Kings	1988-1998	0.940	-	-	0.984	0.047	0.892-1.076

Note: λ is the best estimate of the population rate of change. SE is the standard error of the estimate of λ . 95% CI is the range in the actual value λ for which probability is at least 95%. (Source: Franklin et al. 2003)

As displayed in the table above, λ varies among study areas and analysis methods. It must be noted that in general both methods show a declining trend in populations. The capture-recapture method indicates that the rate of decline may not be as great as originally predicted using the projection-matrix method. However, the capture-recapture methodology is not statistically different than $\lambda = 1$, which would indicate a stable population.

The meta-analysis still identifies a great deal of uncertainty regarding rangewide population trends. The group could not determine whether the results of the meta-analysis were representative of owl demographic trends throughout the Sierra Nevada. For example, if at the inception of these studies, habitat management in the study areas was different than that of the surrounding areas, or changed as a result of study initiation (e.g., study areas were preferentially protected from management activities), then general inference beyond the study areas cannot be made (Franklin et al. 2003).

CASPO Current population status and trend - California

CASPO California Conservation Status. The spotted owl is “vulnerable” (“vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation”) in California (NatureServe 2007).

CASPO California Population Trend Index. A recently completed report on California spotted owl population dynamics (Franklin et al. 2003) concluded that the population trend data for the entire range of the California spotted owl is inconclusive, and statistical trends do not indicate a decline in the overall California spotted owl population. However, they felt that concern may still be warranted for the San

Bernardino population, based on results of the analysis, and recommend reinstating the San Bernardino demography study.

In 2003, the U.S. Fish and Wildlife Service (USFWS) published the 12 month finding for a petition to list the California Spotted Owl in the Federal Register (USFWS 2003). The USFWS concluded, after analysis of all available data, that there exists no clear statistical evidence to show that the California Spotted Owl is declining throughout its range. In 2006, The US Fish and Wildlife Service re-assessed the status of the California spotted owl and determined that the best available data indicated that California spotted owl populations are stationary throughout the Sierra Nevada (USFWS 2006).

CASPO Current population status and trend – Range-wide

CASPO Range-wide Conservation Status. The Global and National conservation status of the spotted owl is “Vulnerable” (“at moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors”) (NatureServe 2007). The Global Short-term Trend is “Declining (decline of 10-30%)” (Ibid).

CASPO Range-wide Population Trend Index. The global abundance is estimated at 2500 - 10,000 individuals, including several thousand pairs (NatureServe 2007).

CASPO-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in the rate of population change, the distribution of California spotted owl populations in the Sierra Nevada is stable.

CASPO References Cited

Blakesley, J.A., B.R. Noon, and D.W.H. Shaw. 2001. Demography of the California spotted owl in Northeastern California. *The Condor* 103(4):667-677.

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Franklin, A.; Gutiérrez, R.; Nichols, J.; Seamans, M.; White, G.; Zimmerman, G.; Hines, J.; Munton, T.; LaHaye, W.; Blakesley, J.; Steger, G.; Noon, B. 2003. *Population dynamics of the California spotted owl: A meta-analysis*. Final Report to U.S. Forest Service, Pacific Southwest Research Station, Berkeley, CA.

Gould, G. I., Jr. 1974. The status of the spotted owl in California. Calif. Dep. Fish and Game, Sacramento, Admin. Rep. No. 74-6. 36pp.

Gutierrez, R.J., A.B. Franklin, and W.S. Lahaye. 1995. Spotted Owl; *Strix occidentalis*. The Birds of North America, No. 179.

Gutierrez, R.J., W.S. LaHaye, and G.Zimmerman. 1999. Demography of the California spotted owl in the San Bernardino Mountains, 1998. Final Report to Region 5, U.S.D.A. Forest Service. Submitted March 1999. 14pp.

Gutiérrez, R.J., D.J. Tempel, and W. Berigan. 2008. Population ecology of the California spotted owl in the Central Sierra Nevada: Annual Results 2007: Region 5, USDA Forest Service (CR Agreement: 06-CR-11052007-174). June, 2008. 29pp.

Gutiérrez, R.J., D.J. Tempel, and W. Berigan. 2009. Population ecology of the California spotted owl in the Central Sierra Nevada: Annual Results 2008: Region 5, USDA Forest Service (CR Agreement: 06-CR-11052007-174). April 2000. 29pp.

Gutiérrez, R.J., D.J. Tempel, and W. Berigan. 2010. Population ecology of the California spotted owl in the Central Sierra Nevada: Annual Results 2009: Region 5, USDA Forest Service (CR Agreement: 06-CR-11052007-174). March 2010. 29pp.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

Sierra Nevada Research Center. 2008. Plumas Lassen Study 2007 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 310pp.
http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2007.pdf

Sierra Nevada Research Center. 2009. Plumas Lassen Study 2008 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 223pp.

http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2008.pdf

Sierra Nevada Research Center. 2010. Plumas Lassen Study 2009 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 184pp.

http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2009.pdf

Steger, G.N., L.R. Werner, and T.E. Munton. 1999. First documented record of the barred owl (*Strix varia*) in the southern Sierra Nevada. Western Birds.

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. January 2001.

USDA Forest Service 2004. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. 2004.

USDA Forest Service. 2006. Sierra Nevada forest plan accomplishment monitoring report for 2005. USDA Forest Service, Pacific Southwest Region R5-MR-036. 12pp.

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USFWS. 2003. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition To List the California Spotted Owl (*Strix occidentalis occidentalis*). Federal Register: Volume 68, Number 31, Page 7580-7608. February 14, 2003. From the Federal Register Online via GPO Access [wais.access.gpo.gov]

USFWS. 2006. Endangered and Threatened Wildlife and Plants; 12-month Finding for a Petition to List the California Spotted Owl (*Strix occidentalis occidentalis*) as Threatened or Endangered. Department of the Interior, Fish and Wildlife Service, 50 CFR Part 17. Federal Register: May 24, 2006, Volume 71, Number 100, pages 29886-29908.

Verner, J., K.S. McKelvey, B.R. Noon, R.J. Gutierrez, G.I. Gould, Jr., and T.W. Beck. tech. coord. 1992. The California Spotted Owl: a technical assessment of its current status. Gen. Tech. Rep. PSW-GTR-133, US Forest Service, Albany, CA.

Fox Sparrow (*Passerella iliaca*) (FOSP)

FOSP-I. Overview of Species.

The fox sparrow (*Passerella iliaca*) is the Management Indicator Species (MIS) for shrubland habitat (west-slope chaparral) on seven of the Sierra Nevada national forests (Eldorado, Lassen, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests) (USDA Forest Service 2007).

This species occurs across North America, breeding primarily in the intermountain west and across northern Canada to Alaska (NatureServe 2007) (Figure FOSP-I-1). In California, the fox sparrow occurs throughout the State except in the southeast, and breeds commonly in dense montane chaparral and brushy understory of other wooded, montane habitats (CDFG 2005) (Figure FOSP-I-2). Fox Sparrows nesting in the Sierra Nevada of California migrate only short distances, mostly altitudinally (Weckstein et al. 2002).

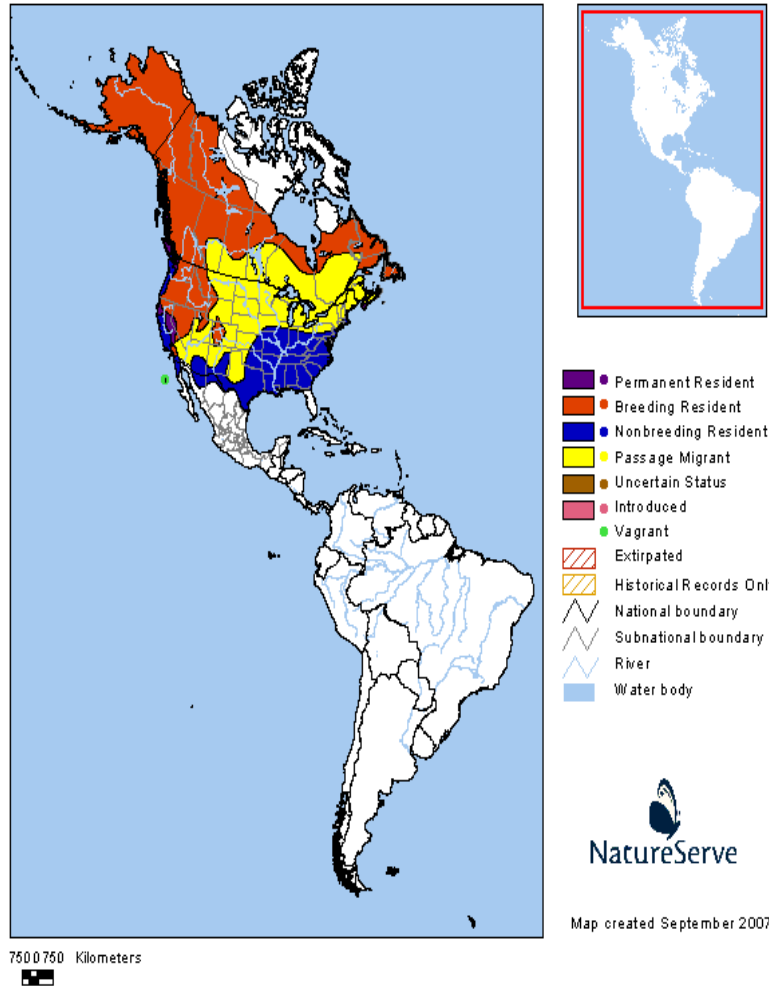


Figure FOSP-I-1. Range-wide distribution of Fox sparrow (Ridgely et al. 2003 in NatureServe 2007).

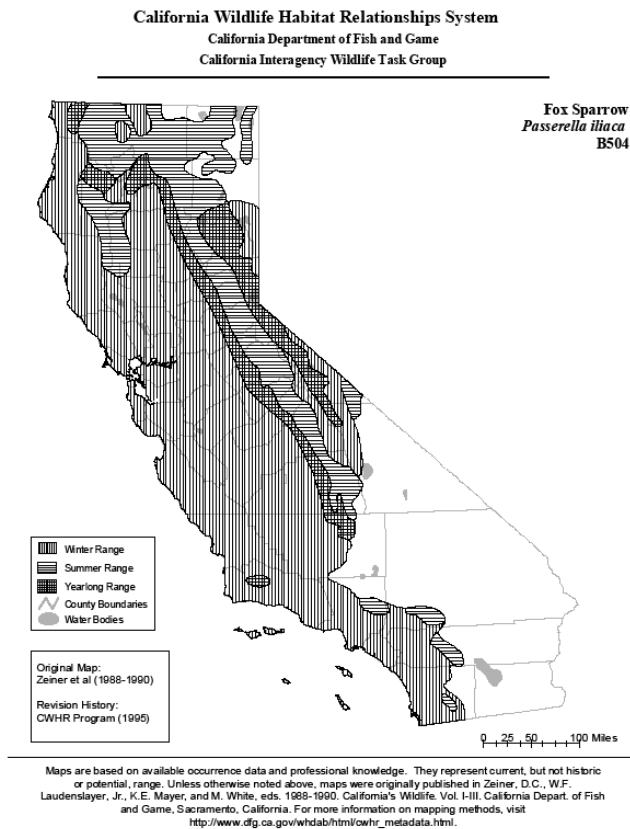


Figure FOSP-I-2. Distribution of fox sparrow in California (CDFG 2005).

FOSP-I.A. General Suitable Habitat. Suitable fox sparrow habitat includes extensive brushfields and by thickets scattered in forest stands, and the species prefers montane chaparral for breeding (CDFG 2005). Recent empirical data from the Sierra Nevada indicate that, in the Sierra Nevada, the fox sparrow is dependent on open shrub-dominated habitats for breeding (Burnett and Humple 2003, Sierra Nevada Research Center 2007).

In the Sierra Nevada, peak densities of fox sparrows were about 1 pair per hectare (Zink 1986 in Weckstein et al. 2002). Density of nesting fox sparrows on the Lassen National Forest averaged over two acres per territory (PRBO unpublished data in Sierra Nevada Research Center 2007).

FOSP-I.B. Food Habits. Fox sparrows feed on small fruits (e.g., seeds, berries) and small invertebrates (e.g., spiders, insects, millipedes), and usually forage beneath dense brush (CDFG 2005).

FOSP-I.C. Reproductive Habits. In California, the fox sparrow breeds mid-May into early August, laying 2-5 eggs in a bulky cup nest, usually on the ground or low in the dense foliage of a shrub (CDFG 2005). On the Lassen National Forest, the majority

(76%) of fox sparrow nests were found in Mountain Whitethorn (*Ceanothus cordulatus*) (Burnett & Humple 2003).

Recent empirical data from the Sierra Nevada indicate that, in the Sierra Nevada, the fox sparrow is dependent on open shrub-dominated habitats for breeding (Burnett and Humple 2003, Burnett et al. 2005, and Sierra Nevada Research Center 2007). Data from the Lassen National Forest indicate that fox sparrow nests are positively correlated with total shrub cover, the cover of green-leaf manzanita, bush chinquapin, and mountain whitethorn, and litter depth (Burnett et al. 2005).

FOSP-I.D. Risks and Management Concerns. Fox sparrow nests are parasitized by brown-headed cowbirds (CDFG 2005).

FOSP-II. Habitat Relationships

The fox sparrow was selected as the MIS for shrubland (chaparral) habitat on the west-slope of the Sierra Nevada, comprised of montane chaparral (MCP), mixed chaparral (MCH), and chamise-redshank chaparral (CRC) as defined by the California Wildlife Habitat Relationships System (CWHR) (CDFG 2005). See Appendix A for details on CWHR. In general, montane chaparral is predominately comprised of ceanothus species, manzanita species, and bitter cherry; mixed chaparral is predominantly comprised of scrub oak, ceanothus species, and manzanita species; and chamise-redshank chaparral is predominantly comprised of chamise, redshank, and ceanothus species. Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

FOSP-III. Habitat Status and Trend.

Currently, there are 1,009,681 acres of west-slope chaparral shrubland habitat on National Forest System lands in the Sierra Nevada (1,128,859 acres on all ownerships). The trend is slightly increasing: over the last two decades, west-slope shrubland habitat changed from comprising 8% of the National Forest System land acres in the Sierra Nevada to 9%. See the Habitat Monitoring Section of this Report for more detailed information.

FOSP-IV. Population Status and Trend.

FOSP Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

Monitoring of mountain quail (*Oreortyx pictus*), Hairy Woodpecker (*Picoides villosus*), Fox Sparrow (*Passerella iliaca*), and Yellow Warbler (*Dendroica petechia*) across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science. The sampling protocol and data collected can be found at: <http://data.prbo.org/partners/usfs/snmis/>. The 2009 and 2010 results for are summarized below.

In each year, 500 upland transects were targeted. In 2009, 50 riparian transects were targeted; in 2010, this was increased to 100. The number of transects (cluster of four or five point count stations) visited each year are listed in Table FOSP-1.

Table FOSP-1. Number of transects (cluster of four or five point count locations) visited in the 2009 and 2010.

sample set	2009			2010		
	transects	revisits	revisit rate	transects	revisits	revisit rate
upland	415	250	60.2	464	267	57.5
riparian	43	16	37.2	94	65	69.1

The monitoring results are displayed in Table FOSP-2, including the number of individuals recorded and MIS prevalence on points and transects. The number of sites visited increased from 2009 to 2010 for all the samples due to larger field crew size (15 in 2010 vs 12 in 2009), and the number of individuals and number of survey locations where species were encountered increased correspondingly. In most cases, the proportion of survey locations where MIS were recorded also increased from 2009 to 2010.

Table FOSP-3 lists the average abundance per point count of all individuals within 100m by forest for 2009 and 2010 and for both the upland (Fox Sparrow, Mountain Quail, and Hairy Woodpecker) and riparian (Yellow Warbler) samples. Note that only about 50% of the sites used in this analysis were surveyed in both years. In addition, using only records up to 100m estimated distance from observer about 80% of all Mountain Quail records.

Table FOSP-2. Field records of MIS from 2010 and 2011.

Upland	2009			2010		
Spp	individuals counted	% of 1659 points	% of 415 transects	individuals counted	% of 2266 points	% of 464 transects
FOSP	1705	36.9	56.1	2748	44.3	64.4
MOUQ	1188	40.3	62.9	1945	47.4	75.0
HAWO	313	15.1	41.2	439	16.7	53.2
YWAR	188	6.9	15.9	272	6.4	15.5

Playback	2009			2010		
Spp	individuals counted	% of 424 points	% of 410 transects	individuals counted	% of 492 points	% of 464 transects
MOUQ	464	48.6	62.4	592	55.3	72.0
HAWO	140	25.2	28.3	156	25.6	28.6

Riparian	2009			2010		
Spp	individuals counted	% of 160 points	% of 43 transects	individuals counted	% of 397 points	% of 94 transects
YWAR	36	13.7	30.2	213	19.4	31.6

Table FOSP 3. Average abundance (number of individuals recorded on passive point count surveys – i.e. no playback data are included) of MIS per point count location by forest.

Forest	Upland 2009				Riparian 2009	
	Fox Sparrow	Hairy Woodpecker	Mountain Quail	sample size	Yellow Warbler	sample size
Eldorado	0.847	0.147	0.294	160	0	6
Inyo	0.254	0.276	0.022	67	0	8
Lassen	0.169	0.169	0.005	198	0.469	16
Modoc	0.249	0.084	0.018	225	0	40
Plumas	0.555	0.189	0.065	217	0.294	34
Sequoia	0.848	0.058	0.071	197	0.222	9
Sierra	0.559	0.072	0.071	290	0.061	33
Stanislaus	0.801	0.057	0.259	168	0	6
Tahoe	0.788	0.106	0.190	137	0.625	8
Sierra Nevada total	0.563	0.116	0.103	1659	0.166	160
Forest	Upland 2010				Riparian 2010	
	Fox Sparrow	Hairy Woodpecker	Mountain Quail	sample size	Yellow Warbler	sample size
Eldorado	0.928	0.097	0.095	221	0	16
Inyo	0.178	0.173	0.067	104	1.063	16
Lassen	0.293	0.067	0.024	374	0.451	82
Modoc	0.170	0.090	0.063	223	0	67
Plumas	0.729	0.100	0.040	291	0.569	65
Sequoia	1.135	0.250	0.157	270	0.077	26
Sierra	0.739	0.041	0.106	339	0.038	52
Stanislaus	0.749	0.122	0.129	213	0.163	40
Tahoe	1.247	0.091	0.065	231	0.636	33
Sierra Nevada total	0.701	0.107	0.081	2266	0.309	397

These data indicate that fox sparrows continue to be distributed across the 10 Sierra Nevada National Forests.

In addition, the fox sparrow has been monitored and surveyed in the Sierra Nevada at various sample locations by avian point count, spot mapping, mist-net, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008).

FOSP Current population status and trend - California

FOSP California Conservation Status. Not ranked / under review.

FOSP California Population Trend Index. BBS trend for California from 1968-2005 is 0.6, range -0.7 to 1.9 ($p=0.36$, $N=54$) with a regional credibility ranking of blue (data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes) (Sauer et al. 2007).

FOSP Current population status and trend – Range-wide

FOSP Range-wide Conservation Status. The Global and National conservation status of the fox sparrow is G5-Secure (“demonstrably widespread, abundant, and secure”) and the National conservation status is N5B (secure breeding status) N5N (secure non-breeding status).

FOSP Range-wide Population Trend Index. BBS trend for the United States from 1968-2006 is 0.3, range -0.7 to 1.3 ($p=0.52$, $N=174$) with a regional credibility ranking of blue (data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes). Survey-wide BBS trend for the same period is -0.1, range -2.1 to 2.0 ($p=0.95$, $N=248$), also with a blue regional credibility ranking (Sauer et al. 2007). As of 1999, BBS data generated an average of 16.51 birds/route over the 16 routes in the Sierra Nevada and indicated a likely stable trend (Siegel and DeSante 1999).

FOSP-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in the population trend, the distribution of fox sparrow populations in the Sierra Nevada is stable.

FOSP References Cited

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version.
<http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2003. Digital Distribution Maps of the Birds of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSPACE."

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. [USGS Patuxent Wildlife Research Center](http://www.pwrc.usgs.gov/bbs/), Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight. Available on-line: <http://www.prbo.org/calpif/htmldocs/sierra.html>.

Siegel, R.B. and D.R. Kaschube. 2007. Landbird Monitoring Results from the Monitoring Avian Productivity and Survivorship (MAPS) Program in the Sierra Nevada. Final report in fulfillment of Forest Service Agreement No. 05-PA-11052007-141. The Institute for Bird Populations. February 13, 2007. 33pp.

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

Weckstein, Jason D., Donald E. Kroodsmas, and Robert C. Faucett. 2002. Fox Sparrow (*Passerella iliaca*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/715>.

Greater Sage-grouse (*Centrocercus urophasianus*) (GRSA)

GRSA-I. Overview of Species.

The greater sage-grouse (*Centrocercus urophasianus*) is the Management Indicator Species (MIS) for sagebrush habitat on two of the ten Sierra Nevada national forests (Inyo and Modoc) (USDA Forest Service 2007).

The greater sage-grouse occurs locally within sagebrush habitat within the intermountain west of North America, from central Washington, southern Idaho, Montana, southeastern Alberta, southwestern Saskatchewan, southwestern North Dakota, and western South Dakota south to east-central California, south-central Nevada, southern Utah, and northwestern Colorado (NatureServe 2007) (Figure GRSA-I-1). In California, it is an uncommon permanent resident in northeastern California, ranging from the Oregon border along the east side of the Cascade Range and Sierra Nevada to northern Inyo County (CDFG 2005) (Figure GRSA-I-2). It is a hunted species in California (CDFG 2004).



Figure GRSA-I-1. Range-wide distribution of greater sage-grouse (Connolly et al. 2004).

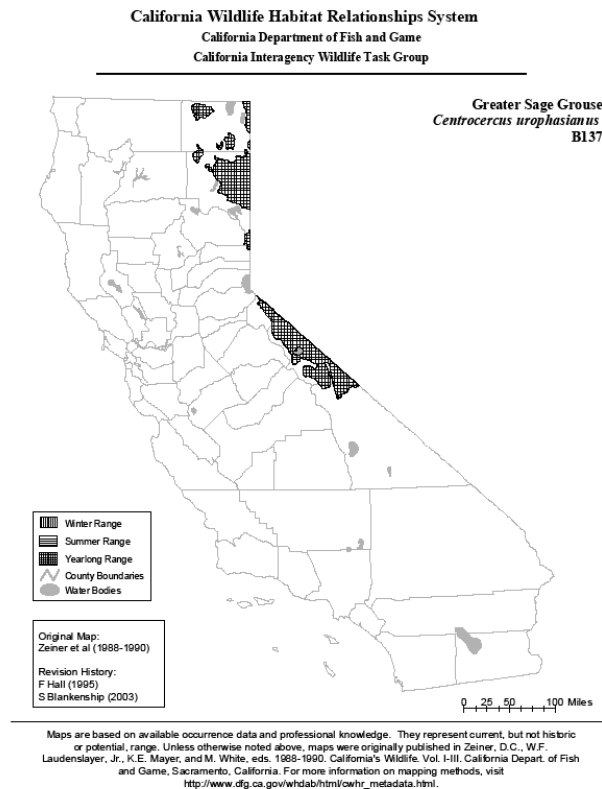


Figure GRSA-I-2. Distribution of greater sage-grouse in California (CDFG 2005).

GRSA-I.A. General Suitable Habitat. The greater sage-grouse is dependent on sagebrush (*Artemisia* spp.) for both food and cover (Connelly et al. 2004, USFWS 2005), and sage-grouse distribution is strongly correlated with the distribution of sagebrush habitats (USFWS 2005). As vegetation in upland sagebrush habitats desiccate, hens move to more mesic sites, such as riparian, wet meadows, and sagebrush grasslands, to summer and rear broods (Connelly et al. 2000). Productive nesting habitat includes sagebrush with horizontal and vertical structural diversity, including sagebrush generally 30-80cm tall with a canopy of 15-25% and an understory composed of native grasses and forbs (Connelly et al. 2000).

Schroeder et al. (1999) (Birds of North America) summarized data for greater sage-grouse home range size: breeding range: 0.1–28.6 km² (Schroeder et al. 1999 referencing Connelly 1982, Bradbury et al. 1989a, Hofmann 1991, and Schroeder unpublished data); summer range: 0.1–25.9 km² (Schroeder et al. 1999 referencing Oakleaf 1971, Wallestad 1971, Connelly 1982, Bradbury et al. 1989a, Hofmann 1991, and Schroeder unpublished data); autumn range: 22.5–44.2 km² (Schroeder et al. 1999 referencing Connelly 1982 and Hofmann 1991); and winter range: 0.6–18.2 km² (Schroeder et al. 1999 referencing Schroeder unpublished data).

GRSA-I.B. Food Habits. Adults feed primarily on sagebrush in winter, and on forbs and insects (mostly ants and grasshoppers) in other seasons; chicks feed primarily on insects (CDFG 2005).

GRSA-I.C. Reproductive Habits. Each spring, greater sage-grouse perform an elaborate display for females (strutting display) on communal breeding grounds called leks, which are relatively open sites often surrounded by denser shrub-steppe cover (USFWS 2005). In California, breeding occurs from mid-February to late August, with the peak strutting period from March to April (CDFG 2005). A clutch of 5-13 eggs (usually 7-8) is laid in a shallow scrape nest thinly lined with plant material and often placed under sagebrush (Ibid). Sage-grouse exhibit strong site fidelity to breeding and nesting areas (USFWS 2005).

GRSA-I.D. Risks and Management Concerns. The following factors are affecting sage-grouse (USFWS 2005): habitat loss and fragmentation from a variety of factors, including invasive species, infrastructure related to energy development and urbanization, wildfire, agriculture, grazing, energy development, urbanization, strip/coal mining, weather, and pinyon-juniper expansion.

GRSA-II. Habitat Relationships

The greater sage-grouse was selected as the MIS for sagebrush habitat in the Sierra Nevada. Detailed descriptions of this habitat can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

Habitat relationship information for the greater sage-grouse is well-defined (e.g., Connelly et al. 2000, Connelly et al. 2004, USFWS 2005), and MIS monitoring for the greater sage-grouse is focused on monitoring habitat trends.

The California Department of Fish and Game (CDFG) regularly reviews the existing resident game bird hunting regulations, including those for the greater sage-grouse in the Sierra Nevada (CDFG 2004). The most recent review identified the following acreage of sagebrush habitat across the range in California (Sierra Nevada): 1,628,330 acres of sagebrush and 128,953 acres of low sagebrush, for a total of 1,757,283 acres, which resulted in an estimated total adult population of between 9,360 and 24,922.

Detailed habitat relationship descriptions are presented below.

Breeding Habitat: Sage-grouse breeding habitats are defined as those where lek attendance, nesting, and early brood-rearing occur; these habitats are sagebrush-dominated rangelands, typically consisting of large, relatively contiguous sagebrush stands, and are critical for survival of sage-grouse populations (Connelly et al. 2004).

Leks: Leks can range from less than 0.04 hectares (0.1 acre) to over 36 hectares (90 acres) (Connelly et al. 2004, USFWS 2005). They are located in relatively

open areas with less herbaceous and shrub cover than adjacent areas and often have gentle slopes; these areas may be natural openings or openings created by human disturbance (Connelly et al. 2004). Leks are usually surrounded by potential nesting habitat (see below) and are adjacent to relatively dense sagebrush stands which are used for cover (Ibid). The average distance between leks and nests vary from 1.1 to 6.2 km, but may be >20 km (Connelly et al. 2000).

Nesting Habitat: Nesting habitat for greater sage-grouse is commonly a large area within or near winter range (see below) or between winter and summer range; the best habitat includes sagebrush with horizontal and vertical structural diversity and an understory of native grasses and forbs (Connelly et al. 2004). Nest sites most commonly have sagebrush 29-80cm tall; nests tend to be under the tallest sagebrush within a stand (Connelly et al. 2000). Grass height and cover of nest sites tend to be taller and denser than adjacent sites (Ibid).

Early Brood-rearing Habitat: The first 2-3 weeks after hatching, hens rear their broods in upland sagebrush habitat relatively close to nest sites in areas with great plant richness and abundant forbs (Connelly et al. 2000, Connelly et al. 2004).

Late Brood-rearing Habitat: During June and July, as sagebrush habitats desiccate, sage-grouse usually move to more mesic sites, typically characterized by abundant forbs and insects (Connelly et al. 2000, Connelly et al. 2004). A variety of summer habitats are used, including sagebrush, small burned areas within sagebrush, wet meadows, and farmlands or irrigated areas adjacent to sagebrush (Connelly et al. 2000).

Autumn Habitat: This habitat, which may be used from late August to mid-December, is transitional habitat used as breeding habitat dries out and begins to frost and as sage-grouse change from their summer diet (variety of forbs, insects, and sagebrush) to their winter diet of predominantly sagebrush (Connelly et al. 2005). A variety of habitats are used, dependent on availability, elevation, topography, water, distance between summer and winter habitats, and weather conditions; habitats include upland meadows, riparian areas, alfalfa fields, and irrigated native hay pastures (Ibid).

Winter Habitat: Winter sage-grouse habitat is dominated by sagebrush, which provides winter shelter and food; location of this habitat is determined by variation in topography and above-snow availability of sagebrush under a variety of weather conditions (Connelly et al. 2004). Mean canopy cover of sagebrush in winter habitat may vary from 12-43% and mean height of sagebrush above the snow may range from 20cm-54cm (Connelly et al. 2000).

GRSA-III. Habitat Status and Trend.

GRSA Sierra Nevada / California Habitat Status and Trend - The quality and quantity of sagebrush habitats have declined for at least the last 50 years throughout the range of

the greater sage-grouse (Connelly et al. 2000), including in California (Sierra Nevada). The rate of this decrease has slowed (USFWS 2005).

On National Forest System lands in the Sierra Nevada, there are currently 919,250 acres of sagebrush habitat. Within the last decade in the Sierra Nevada, the habitat trend is essentially stable. See the Habitat Monitoring Section of this Report for more detailed information.

GRSA Range-wide Habitat Status and Trend – The sagebrush biome currently covers approximately 480,000 km² (118.6 million acres) and includes 14 states and 3 provinces (Connelly et al. 2004). Prior to 1800, sagebrush habitats occurred over approximately 1,200,483 km² (USFWS 2005). Three basic habitat characteristics have changed: (1) reduction in the total land area dominated by sagebrush in many regions, (2) changed composition, primarily altered understory (e.g., replacement of native perennial bunchgrasses by cheatgrass) and soils, and (3) changed configuration, leading to habitat fragmentation and increased edge (Connelly et al. 2004).

In March, 2010, USFWS announced that the greater sage-grouse and the Bi-State sage-grouse distinct population segment warrant protection under the Endangered Species Act of 1973, as amended (Act), but that listing them at this time is precluded by the need to first pursue the listing of higher priority species (USFWS 2010). Both are now Candidate species under the Act. The major threat identified by the USFWS is current and future destruction, modification, or curtailment of habitats in the Bi-State area due to urbanization, infrastructure, mining, energy development, grazing, invasive and exotic species, pinyon–juniper encroachment, recreation, wildfire, and the likely effects of climate change (IBID).

GRSA-IV. Population Status and Trend.

Not applicable. Greater sage-grouse only requires habitat monitoring (USDA Forest Service 2007).

GRSA-V. Status and Trend Summary for the Sierra Nevada National Forests

Current data from California and the Sierra Nevada indicate that, although habitat quantity and quality has decreased historically, the current habitat trend for greater sage-grouse is stable. However, current and future threats to the habitat have been identified and the greater sage-grouse and the Bi-State sage-grouse distinct population segment are now Candidate species under the Federal Endangered Species Act (USFWS 2010).

GRSA References Cited

CDFG (Calif. Dept. Fish and Game). 2004. Resident game bird hunting, Final Environmental Document. State of California, The Resources Agency, Department of Fish and Game, August 5, 2004. 182pp + appendices.

CDFG (Calif. Dept. Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildl. Soc. Bull. 28:967-985.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Greater Sage-Grouse (*Centrocercus urophasianus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/425doi:bna.425>

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USFWS. 2010. Endangered and Threatened Wildlife and Plants; 12-month Finding for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered; Proposed Rule. Department of the Interior, Fish and Wildlife Service, 50 CFR Part 17. Federal Register: March 23, 2010, Volume 75, Number 55, pages 13910-14014.

Hairy Woodpecker (*Picoides villosus*) (HAWO)

HAWO-I. Overview of Species.

The hairy woodpecker (*Picoides villosus*) is the Management Indicator Species (MIS) for the ecosystem component snags within green forest on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007).

The hairy woodpecker breeds from western and central Alaska to northern Saskatchewan and Newfoundland, south to northern Baja California, highlands of Middle America, Gulf Coast, southern Florida, and Bahamas; it generally winters throughout the breeding range, with more northern populations partially migratory (NatureServe 2007) (Figure HAWO-I-1). In California, the hairy woodpecker is a fairly common, permanent resident of mixed conifer and riparian deciduous habitats from sea level to 2,700 m (0-9,000 ft) elevation throughout much of the State, but is very scarce in portions of coastal southern California, Central Valley, Salinas Valley, Mojave and Colorado deserts, and Great Basin (CDFG 2005) (Figure HAWO-I-2).

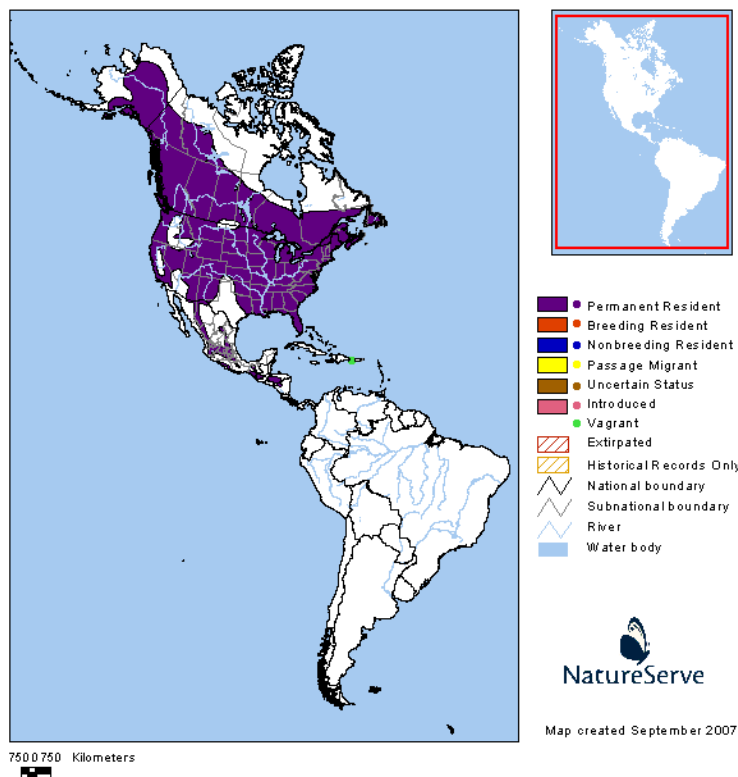


Figure HAWO-I-1. Range-wide distribution of hairy woodpecker (Ridgely et al. 2003 in NatureServe 2007).

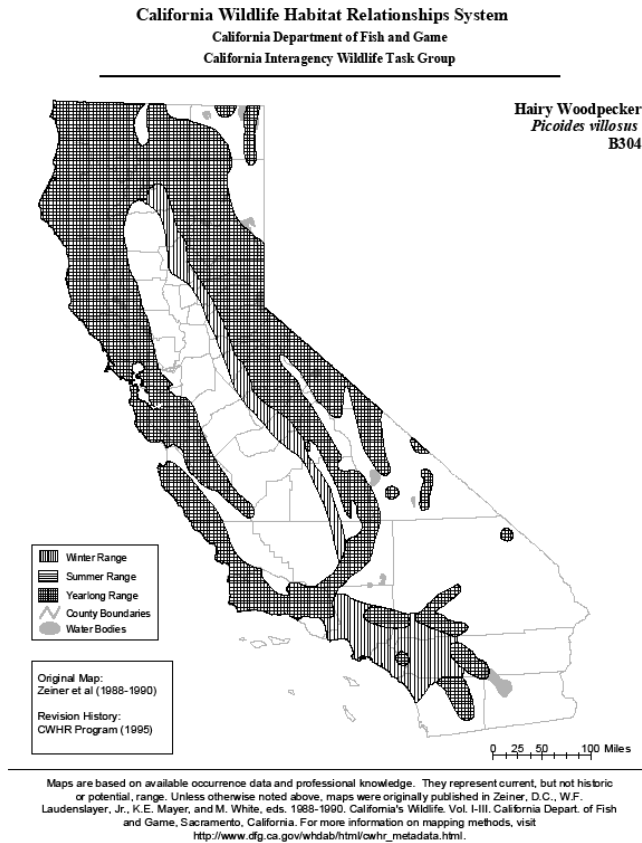


Figure HAWO-I-2. Distribution of hairy woodpecker in California (CDFG 2005).

HAWO-I.A. General Suitable Habitat. The hairy woodpecker uses stands of large, mature trees and snags of sparse to intermediate density; cover is also provided by tree cavities (CDFG 2005). Mature timber and dead snags or trees of moderate to large size are apparently more important than tree species (Siegel and DeSante 1999).

Territory and home range are apparently the same. Reported territory size ranges from 0.6 to 15 hectares (NatureServe 2007). In a mature conifer forest in central Ontario, breeding territories averaged 2.8 hectares (7 acres), and ranged from 2.4 to 3.2 hectares (6-8 acres) (NatureServe 2007 and CDFG 2005 referencing Lawrence 1967). In Washington State, average home range size varied from 58 hectares (minimum convex polygon) to 54.4 hectares (fixed kernel) (Ripper et al. 2007). Population densities are estimated to range from 0.6 pairs/km² in Oregon riparian habitat (Jackson et al. 2002 referencing Anthony et al. 1996) to approximately 15 pairs/km² in Maryland (Jackson et al. 2002 referencing C. Robbins in Ricciardi 1996).

HAWO-I.B. Food Habits. The hairy woodpecker drills, pecks, and probes in crevices of bark of dead and live trees, logs, and stumps, foraging primarily for arthropods (CDFG 2005).

HAWO-I.C. Reproductive Habits. Hairy woodpecker breeds from mid-March to late August, with peak nesting activity in late May through June, laying one brood of 3-6 eggs in an excavated nest cavity within a snag (CDFG 2005). Nests are within dug cavities in live or dead trees or stub and an average of 9 meters above the ground (NatureServe 2007). The reported average dbh of nest trees range from 28cm (11.1 inches) (New Hampshire) to 92cm (36.2 inches) (Oregon) (Sousa 1987). In east-central Sierra Nevada, the average dbh of nest trees was 43.8cm (17.2 inches) (Raphael and White 1984).

HAWO-I.D. Risks and Management Concerns. Activities that remove snags, larger trees, or insects (e.g., pesticide use on forest insect outbreaks) can be of management concern to hairy woodpeckers; loss of riparian habitat may also be a risk (Siegel and DeSante 1999). Local declines may occur when house sparrows or starlings usurp nest cavities (NatureServe 2006).

HAWO-II. Habitat Relationships

The hairy woodpecker was selected as the MIS for the ecosystem component of snags in green forests. Medium (diameter breast height between 15 to 30 inches) and large (diameter breast height greater than 30 inches) are most important.

HAWO-III. Habitat Status and Trend.

The current average number of medium-sized and large-sized snags (> 15" dbh, all decay classes) per acre across major coniferous and hardwood forest types (westside mixed conifer, ponderosa pine, white fir, productive hardwoods, red fir, eastside pine) in the Sierra Nevada ranges from 1.5 per acre in eastside pine to 9.1 per acre in white fir. In 2008, snags in these types ranged from 1.4 per acre in eastside pine to 8.3 per acre in white fir (USDA Forest Service 2008).

Data from the early-to-mid 2000s were compared with the current data to calculate the trend in total snags per acre by Regional forest type for the 10 Sierra Nevada national forests and indicate that, during this period, snags per acre increased within westside mixed conifer (+0.76), white fir (+2.66), productive hardwoods (+0.35), and red fir (+1.25) and decreased within ponderosa pine (-0.16) and eastside pine (-0.14).

Detailed information can be found in the Habitat Monitoring Section of this Report.

HAWO-IV. Population Status and Trend.

HAWO Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007). Distribution population monitoring tracks the changes in

the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

Monitoring of mountain quail (*Oreortyx pictus*), Hairy Woodpecker (*Picoides villosus*), Fox Sparrow (*Passerella iliaca*), and Yellow Warbler (*Dendroica petechia*) across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science. The sampling protocol and data collected can be found at: <http://data.prbo.org/partners/usfs/snmis/>. The 2009 and 2010 results for are summarized below.

In each year, 500 upland transects were targeted. In 2009, 50 riparian transects were targeted; in 2010, this was increased to 100. The number of transects (cluster of four or five point count stations) visited each year are listed in Table FOSP-1 (see the Fox Sparrow account).

The monitoring results are displayed in Table FOSP-2 (see the Fox Sparrow account), including the number of individuals recorded and MIS prevalence on points and transects. The number of sites visited increased from 2009 to 2010 for all the samples due to larger field crew size (15 in 2010 vs 12 in 2009), and the number of individuals and number of survey locations where species were encountered increased correspondingly. In most cases, the proportion of survey locations where MIS were recorded also increased from 2009 to 2010.

Table FOSP-3 (see the Fox Sparrow account) lists the average abundance per point count of all individuals within 100m by forest for 2009 and 2010 and for both the upland (Fox Sparrow, Mountain Quail, and Hairy Woodpecker) and riparian (Yellow Warbler) samples. Note that only about 50% of the sites used in this analysis were surveyed in both years. In addition, using only records up to 100m estimated distance from observer about 80% of all Mountain Quail records.

These data indicate that hairy woodpeckers continue to be distributed across the 10 Sierra Nevada National Forests.

In addition, the hairy woodpecker continues to be monitored and surveyed in the Sierra Nevada at various sample locations by avian point count and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008).

HAWO Current population status and trend - California

HAWO California Conservation Status. Hairy woodpecker is “secure” (“demonstrably widespread, abundant, and secure”) in California (NatureServe 2007).

HAWO California Population Trend Index. BBS trend for California from 1968-2005 is -0.1, range -1.3 to 1.2 ($p=0.93$, $N=110$) with a regional credibility ranking of blue (data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes) (Sauer et al. 2007). As of 1999, BBS data show an average of 1.63 birds/route over 15 routes in the Sierra Nevada, indicating a likely stable trend (Siegel and DeSante 1999).

HAWO Current population status and trend – Range-wide

HAWO Range-wide Conservation Status. The Global and National conservation status of the hairy woodpecker is “Secure” (“demonstrably widespread, abundant, and secure”) (NatureServe 2006). The Global Short-term Trend is “Stable” (unchanged or within plus or minus 10% population, range, area occupied, and/or number or condition of occurrences) (Ibid).

HAWO Range-wide Population Trend Index. BBS trend for the United States from 1968-2006 is 0.6, range 0.0 to 1.2 ($p=0.05$, $N=1854$) with a regional credibility ranking of yellow (data with a deficiency). Survey-wide BBS trend for the same period is 1.5, range 0.8 to 2.1 ($p=0.00$, $N=2289$), also with a yellow regional credibility ranking (Sauer et al. 2007).

HAWO-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of hairy woodpecker populations in the Sierra Nevada is stable.

HAWO References Cited

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version.
<http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Jackson, Jerome A., Henri R. Ouellet and Bette J. Jackson. 2002. Hairy Woodpecker (*Picoides villosus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online:
<http://bna.birds.cornell.edu/bna/species/702> doi: bna.702

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available
<http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Raphael, M.G. and M. White. 1984. Use of Snags by Cavity-Nesting Birds in the Sierra Nevada. Wildlife Monographs No. 86. 66pp.

Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2003. Digital Distribution Maps of the Birds of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSPACE."

Ripper, D., J.C. Bednarz, and D.E. Varland. 2007. Landscape use by hairy woodpeckers in managed forests of Northwestern Washington. *Journal of Wildlife Management* 71(8):2612-2623.

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. [USGS Patuxent Wildlife Research Center](http://www.pwrc.usgs.gov/bbs/), Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight. Available on-line: <http://www.prbo.org/calpif/htmldocs/sierra.html>.

Sousa, P. J. 1987. Habitat suitability index models: hairy woodpecker. U. S. Fish Wildl. Serv. Biol. Rep. 82 (10.146). September 1987. 19 pp.

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

Mountain Quail (*Oreortyx pictus*) (MOQU)

MOQU-I. Overview of Species.

The mountain quail (*Oreortyx pictus*) is the Management Indicator Species (MIS) for early and mid seral coniferous forest habitat on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007).

The mountain quail is a resident bird from southwestern British Columbia (on Vancouver Island, where introduced, perhaps also native), western and southern Washington (introduced), and central Idaho south through the mountains of California and northern and western Nevada to northern Baja California, Mexico, with California encompassing the major part of the range (NatureServe 2007) (Figure MOQU-I-1). In California, mountain quail is a common to uncommon resident, found typically in most major montane habitats of the state (CDFG 2005) (Figure MOQU-I-2). It is a hunted species in California (CDFG 2004a).

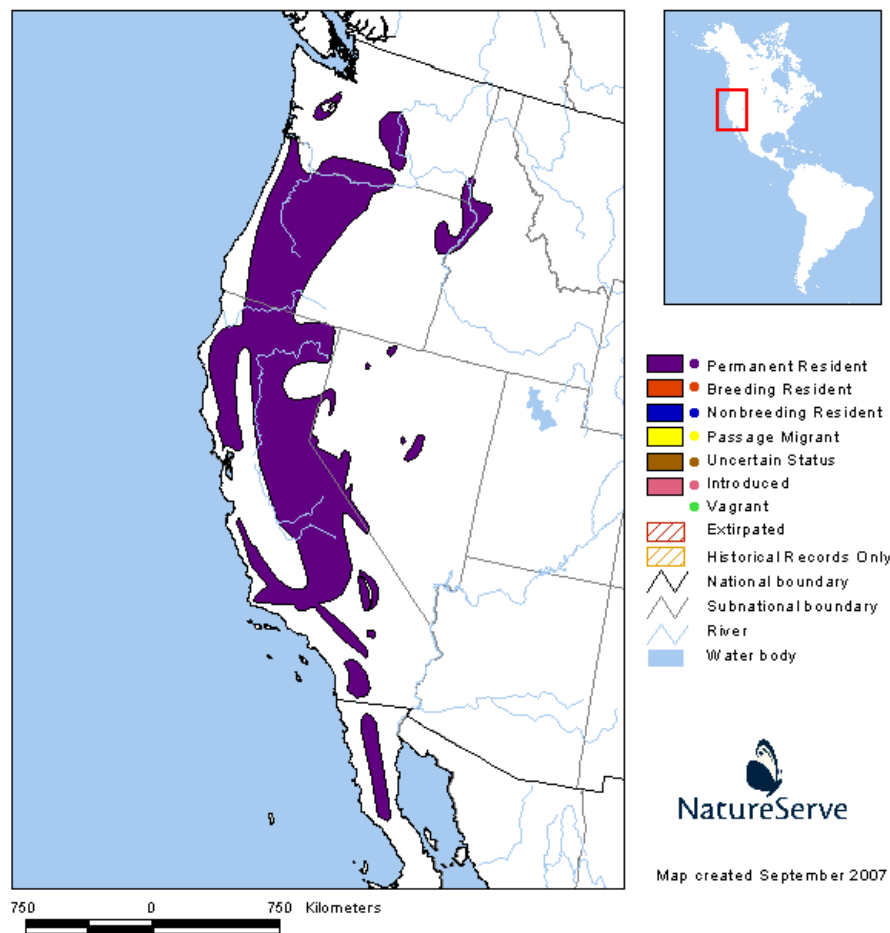


Figure MOQU-I-1. Range-wide distribution of mountain quail (Ridgely et al. 2003 in NatureServe 2007).

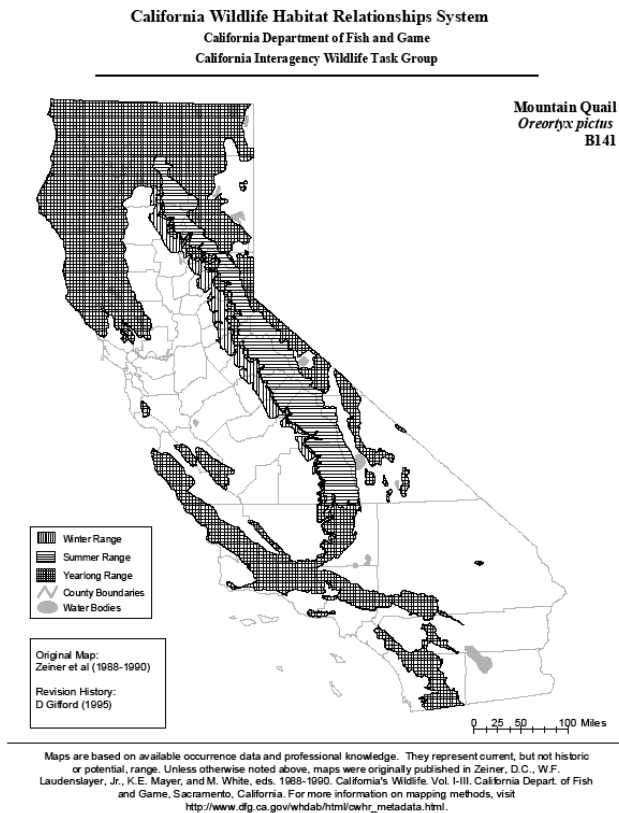


Figure MOQU-I-2. Distribution of mountain quail in California (CDFG 2005).

MOQU-I.A. General Suitable Habitat. The mountain quail is found particularly on steep slopes, in open, brushy stands of conifer and deciduous forest and woodland, and chaparral; it may gather at water sources in the summer, and broods are seldom found more than 0.8 km (0.5 mi) from water (CDFG 2005).

Densities range between 2.6 and 25 acres per bird (CDFG 2004a, referencing Miller 1950); NatureServe (2005) reported that densities of 9-30 individuals per 100 hectares have been recorded in various California habitats.

MOQU-I.B. Food Habits. This species primarily eats green foliage, buds, acorns, flowers, fruits, and seeds of forbs, shrubs, and trees, as well as some arthropods, by gleaning, scratching, plucking, grazing, and browsing on the ground and in foliage (CDFG 2005).

MOQU-I.C. Reproductive Habits. The mountain quail breeds from late March to late August, laying an average of 10 eggs in a ground nest in herbage at the base of trees, in rocks, or near shrubs, logs, or stumps; the brood may remain together through the winter (CDFG 2005).

MOQU-I.D. Risks and Management Concerns. Causes of mortality include the following: predation by accipiters, great horned owl, coyote, bobcat, gray fox, long-tailed weasel, and rattlesnake; accidents, including nests disturbed or trampled by cattle, sheep, and deer, and nests lost to logging activities, and drowning in livestock watering devices without escape ramps and reservoirs too large for quail to fly across; fire; drought; snow and cold; and competition with other species (Gutierrez and Delehanty 1999).

MOQU-II. Habitat Relationships

The mountain quail was selected as the MIS for early and mid seral coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat in the Sierra Nevada. Early seral coniferous forest habitat is comprised primarily of seedlings (<1" dbh), saplings (1"-5.9" dbh), and pole-sized trees (6"-10.9" dbh). Mid seral coniferous forest habitat is comprised primarily of small-sized trees (11"-23.9" dbh). Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

MOQU-III. Habitat Status and Trend.

There are currently 530,851 acres of early seral and 2,776,022 acres of mid seral coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada.

The trend for early seral coniferous forest is decreasing; over the two decades, early seral coniferous forest habitat changed from comprising 9% of the National Forest System land acres in the Sierra Nevada to 5%. The trend for mid seral coniferous forest habitat is increasing; over the two last decades, mid seral coniferous forest habitat changed from comprising 21% of the National Forest System land acres in the Sierra Nevada to 25%. See the Habitat Monitoring Section of this Report for more detailed information.

MOQU-IV. Population Status and Trend.

MOQU Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

Monitoring of mountain quail (*Oreortyx pictus*), Hairy Woodpecker (*Picoides villosus*), Fox Sparrow (*Passerella iliaca*), and Yellow Warbler (*Dendroica petechia*) across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science. The sampling protocol and data collected can be

found at: <http://data.prbo.org/partners/usfs/snmis/>. The 2009 and 2010 results for are summarized below.

In each year, 500 upland transects were targeted. In 2009, 50 riparian transects were targeted; in 2010, this was increased to 100. The number of transects (cluster of four or five point count stations) visited each year are listed in Table FOSP-1 (see the Fox Sparrow account).

The monitoring results are displayed in Table FOSP-2 (see the Fox Sparrow account), including the number of individuals recorded and MIS prevalence on points and transects. The number of sites visited increased from 2009 to 2010 for all the samples due to larger field crew size (15 in 2010 vs 12 in 2009), and the number of individuals and number of survey locations where species were encountered increased correspondingly. In most cases, the proportion of survey locations where MIS were recorded also increased from 2009 to 2010.

Table FOSP-3 (see the Fox Sparrow account) lists the average abundance per point count of all individuals within 100m by forest for 2009 and 2010 and for both the upland (Fox Sparrow, Mountain Quail, and Hairy Woodpecker) and riparian (Yellow Warbler) samples. Note that only about 50% of the sites used in this analysis were surveyed in both years. In addition, using only records up to 100m estimated distance from observer about 80% of all Mountain Quail records.

These data indicate that mountain quail continue to be distributed across the 10 Sierra Nevada National Forests.

In addition, the mountain quail continues to be monitored and surveyed in the Sierra Nevada at various sample locations by hunter survey, modeling, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008).

MOQU Current population status and trend - California

MOQU California Conservation Status. Mountain quail is “not ranked, under review” in California (NatureServe 2007). It is listed as a Harvested species. In 2004, Statewide, the spring population of mountain quail was estimated to be from 1,509,619 to 14,515,565 birds (CDFG 2004a).

MOQU California Population Trend Index. BBS trend for California from 1968-2005 is 1.0, range -0.6 to 2.7 ($p=0.22$, $N=114$) with a regional credibility ranking of yellow (data with a deficiency because they are imprecise) (Sauer et al. 2007). BBS data from 1966 to 2002 for mountain quail in California indicate a stable trend in the spring breeding population (trend 0.57, $p=0.47$, $N=110$) (CDFG 2004a).

MOQU Current population status and trend – Range-wide

MOQU Range-wide Conservation Status. The Global and National conservation status of the mountain quail is “Secure” (“demonstrably widespread, abundant, and secure”) (NatureServe 2007). Since the 1940s, hunter surveys and harvest reports indicate that populations have undergone local extinctions throughout their historical range in Nevada but are stable in the eastern Sierra Nevada (NatureServe 2007 referencing USFWS 2003).

MOQU Range-wide Population Trend Index. BBS trend for the United States and survey-wide from 1968-2006 is 0.9, range -0.5 to 2.4 ($p=0.21$, $N=148$) with a regional credibility ranking of yellow (data with a deficiency) (Sauer et al. 2007).

MOQU-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of mountain quail populations in the Sierra Nevada is stable.

MOQU References Cited

CDFG (Calif. Dept. Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Gutiérrez, R. J. and David J. Delehanty. 1999. Mountain Quail (*Oreortyx pictus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/457> doi:bna.457

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2003. Digital Distribution Maps of the Birds of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSpace."

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. [USGS Patuxent Wildlife Research Center](http://www.pwrc.usgs.gov/bbs/), Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

Mule Deer (*Odocoileus hemionus*) (MUDE)

MUDE-I. Overview of Species.

The mule deer (*Odocoileus hemionus*) is the Management Indicator Species (MIS) for oak-associated hardwood and hardwood conifer habitat on seven of the Sierra Nevada national forests (Eldorado, Lassen, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests) (USDA Forest Service 2007).

Mule deer occur from southeastern Alaska south through Canada and most of the western U.S. and Great Plains, to Baja California and southern end of Mexican Plateau (NatureServe 2007) (Figure MUDE-I-1). It is widely distributed throughout most of California, except in deserts and intensively farmed areas without cover, and is a common-to-abundant, yearlong resident or elevational migrant (CDFG 2005) (Figure MUDE-I-2).

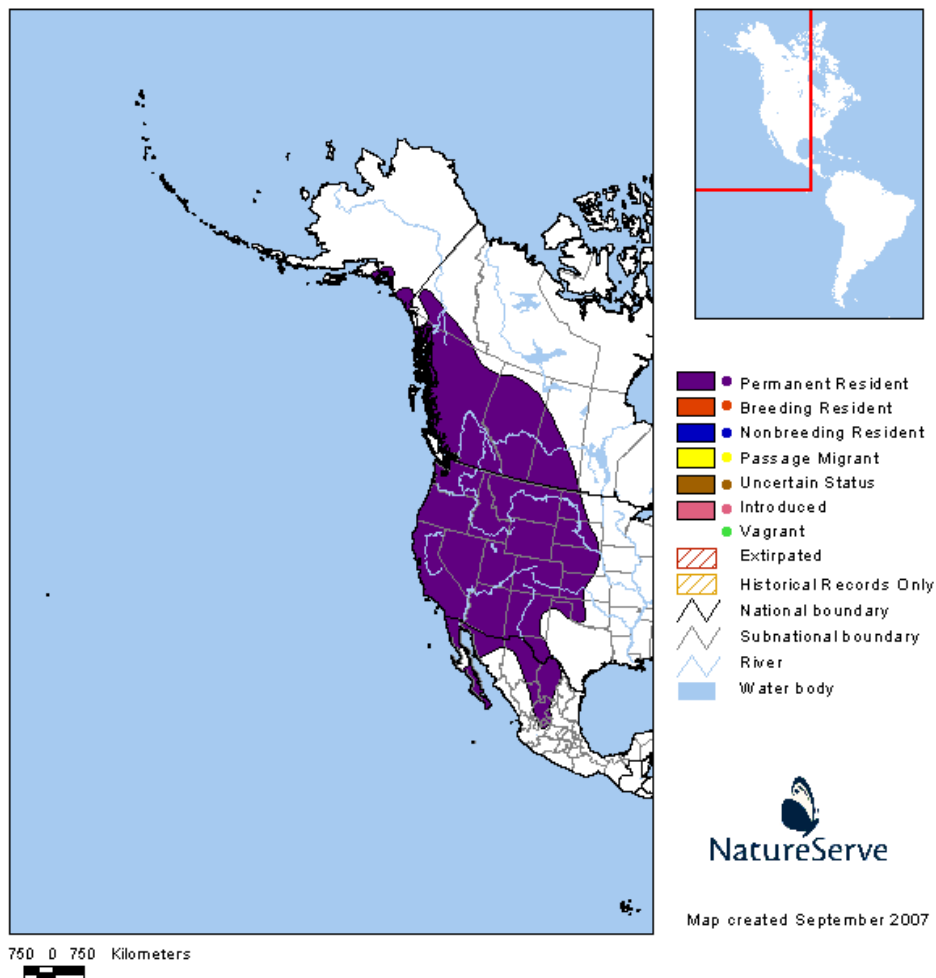


Figure MUDE-I-1. Range-wide distribution of mule deer (Patterson et al. 2003 in NatureServe 2007).

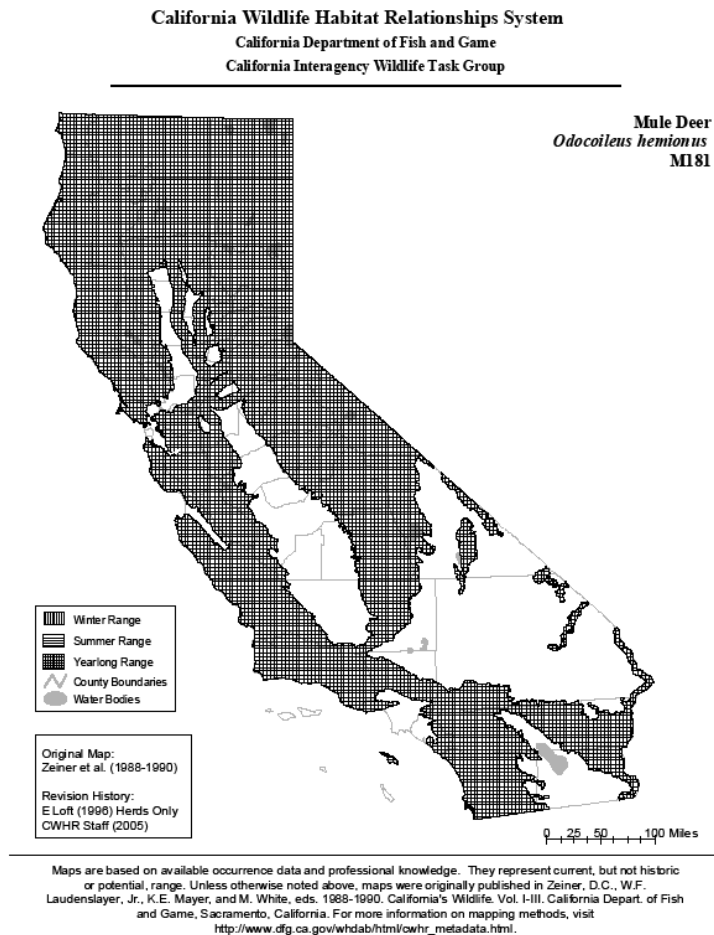


Figure MUDE-I-2. Distribution of mule deer in California (CDFG 2005).

MUDE-I.A. General Suitable Habitat. Mule deer range and habitat includes coniferous forest, foothill woodland, shrubland, grassland, agricultural fields, and suburban environments (CDFG 2005). Many mule deer migrate seasonally between higher elevation summer range and low elevation winter range (Ibid). On the west slope of the Sierra Nevada, oak-associated hardwood and hardwood/conifer areas are an important winter habitat (CDFG 1998).

Home range size may be 30-240 hectares or more and is correlated with the availability of food, water, and cover (NatureServe 2007). Home ranges are usually less than 1.6km (1 mile) in diameter (CDFG 2005). In Lake County, typical home ranges of small doe and fawn groups were 1-3 km² (0.4- 1.1 mi²), but varied from 0.5 to 5.0 km² (0.2 to 1.9 mi²), and territories averaged 0.14 km² (0.09 mi²) (CDFG 2005 referencing Taber and Dasmann 1958).

MUDE-I.B. Food Habits. Mule deer browse and graze on shrubs, forbs, and a few grasses (CDFG 2005). Oak mast (acorns) and oak browse are important foods on the west slope of the Sierra Nevada (CDFG 1998).

MUDE-I.C. Reproductive Habits. Rutting occurs in autumn and 1-2 (rarely 3) fawns are born from early April to mid-summer, usually in areas composed of low shrubs or small trees where interspersed with forage, hiding cover, and thermal cover (CDFG 2005).

MUDE-I.D. Risks and Management Concerns. Mule deer populations can decline in response to habitat fragmentation, degradation, or destruction caused by urban expansion, incompatible use of land resources, and disturbances by humans (CDFG 2005). Mule deer potentially compete with domestic cattle and sheep and black bears for food; they comprise the principle food source for mountain lions and are also preyed upon by bobcats, golden eagles, coyotes, black bears, and domestic dogs (ibid).

MUDE-II. Habitat Relationships

The mule deer was selected as the MIS for oak-associated hardwood and hardwood/conifer in the Sierra Nevada, comprised of montane hardwood (MHW) and montane hardwood-conifer (MHC) as defined by the California Wildlife Habitat Relationships System (CWHR) (CDFG 2005). See Appendix A for details on CWHR. In general in the Sierra Nevada, montane hardwood is comprised primarily of California black oak, with canyon live oak within steep, rocky south slopes of major river canyons (Mayer and Laudenslayer 1988). Montane hardwood-conifer is at least one-third broad-leaved trees (typically California black oak with canyon live-oak, bigleaf maple, white alder, dogwood, and black cottonwood) and one-third conifer (typically Douglas-fir, incense-cedar, ponderosa pine, sugar pine, and Jeffrey pine) (ibid). Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

MUDE-III. Habitat Status and Trend.

There are currently 808,006 acres of oak-associated hardwood and hardwood/mixed conifer habitat on National Forest System lands in the Sierra Nevada (969,565 acres on all ownerships). The trend is slightly increasing; over the last two decades, oak-associated hardwood and hardwood/mixed conifer habitat changed from comprising 5% of the National Forest System land acres in the Sierra Nevada to 7%. See the Habitat Monitoring Section of this Report for more detailed information.

MUDE-IV. Population Status and Trend.***Current population status and trend – Sierra Nevada***

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

The mule deer has been monitored in the Sierra Nevada at various sample locations by herd monitoring (spring and fall) and hunter survey and associated modeling (CDFG 2007). California Department of Fish and Game (CDFG) conduct surveys of deer herds in early spring to determine the proportion of fawns that have survived the winter, and conduct fall counts to determine herd composition (CDFG 2007). This information, along with prior year harvest information, is used to estimate overall herd size, sex and age ratios, and the predicted number of bucks available to hunt (ibid).

Deer herds in California are tracked by Hunt Zones and by 11 Deer Assessment Units (DAUs), which include multiple Hunt Zones, grouped by similarities (CDFG 1998, CDFG 2007) [** = indicate DAU within the Sierra Nevada]:

DAU Number	DAU Name	Hunt Zones within DAU
DAU 1	South Central Coast	South A Zone, D13
DAU 2	N. Central Coast	North A Zone, B4
DAU 3	North Coast	B1, B2, B3, B5, B6
DAU 4 **	Cascade / N. Sierra	C1 through C4
DAU 5 **	Central Sierra	D3 through D7
DAU 6 **	S. Sierra	D8 to D10
DAU 7	S. Coast	D11, D14, D15, D16, D19
DAU 8	Desert	D12, D17, X9c
DAU 9 **	N. Eastern California	X1 through X5b
DAU 10 **	NE Sierra	X6a through X8
DAU 11 **	Eastern Sierra	X9a, X9b, X10, X12

California Department of Fish and Game assesses mule deer population status and trend by both Hunt Zone and DAU as part of their Environmental Documentation for the hunting program (CDFG 2007). Annual variation in deer population estimates may be high due to annual changes in environmental conditions, and varies geographically (ibid).

A summary of deer population status and trend within the Sierra Nevada DAUs and Herd Zones is presented in Table MUDE-IV-1. The Sierra Nevada Forest Plan Amendment (SNFPA) (USDA Forest Service 2001, Table 4.2.2.1a) estimated deer populations for the Six DAUs in the SNFPA Project Area (Table MUDE-IV-2).

Table MUDE-IV-1. Mule Deer Population Status by Hunt Zone within Sierra Nevada Deer Assessment Units (DAUs) (CDFG 2007, Appendices 4-1 and 5-3).

DAU	Hunt Zones	Deer Herds	Buck Ratio Objective	Fall Buck Ratio	Fall Fawn Ratio	Three-year average population CDFG 2007	Three-year average population CDFG 2010	2006 Reported Deer Kill
4 Cascade / N. Sierra	C-1	McCloud Flats, Klamath	20	32	76	3370	5472	232
	C-2	McCloud Flats	25	34	50	4630	3351	122
	C-3	Cow Creek	25	27	35	6620	9179	260
	C-4	East Tehama, Mother Lode	20	36	44	19,170	23,310	906
	D-3	Blue Canyon, Bucks Mountain/Mooretown, Downieville/Nevada City, Mother Lode	25	32	31	16,560	13,754	667
	D-4	Blue Canyon, Mother Lode, Nevada City	30	32	31	3980	5622	157
	D-5	Carson River, Grizzly Flat, Mother Lode, Pacific, Railroad Flat, Salt Springs	18	32	31	25,637	26,551	740
	D-6	Mother Lode, Stanislaus, Tuolumne, Yosemite	30	36	38	22,637	23,308	499
	D-7	Huntington, North Kings, Oakhurst, San Joaquin, South Sierra Foothills	25	33	43	14,503	9732	358
6 S. Sierra	D-8	Greenhorn, Hume, Kaweah, Kern River, South Sierra Foothill, Tule River	25	31	50	11,867	14,523	411
	D-9	Tejon	25	41	40	4,313	4772	164
	D-10	Los Angeles	25	28	55	2,633	2272	165
9 NE California	X-1	McCloud Flats	20	26	68	6833	7531	394
	X-2	Devil's Garden/Interstate	12	12	54	1080	1356	86
	X-3a	Adin, West Lassen	15	27	80	2320	2859	150
	X-3b	Warner Mountains	20	31	63	5003	4427	275
	X-4	Cow Creek, West Lassen, East Lassen	20	20	63	2350	3043	137
	X-5a	East Lassen	25	38	76	637	801	44
	X-5b	East Lassen	25	47	58	1283	1286	87
10 NE Sierra	X-6a	Doyle, Sloat	25	11	50	2527	3045	119
	X-6b	Doyle	25	17	39	1377	2357	92
	X-7a	Loyalton/Truckee	20	22	50	1220	1441	84
	X-7b	Loyalton/Truckee	20	27	35	703	858	45
	X-8	Carson River	25	23	48	752	791	45
11 Eastern Sierra	X-9a	Casa Diablo, Sherwin Grade, Buttermilk	20	25	36	5907	5024	257
	X-9b	Goodale	20	59	52	3170	4487	112
	X-10	Monache	25	32	54	1103	1214	49
	X-12		20	17	46	2730	2979	225

Table MUDE-IV-2. Estimated deer populations (pop.) and densities for 1952 (population high) and 1992 (average population) for the six DAUs within the SNEPA Project Area (SNEPA 2001, Table 4.2.2.1a).

Time Period	Total Mule Deer Numbers and Density						
	Deer Assessment Unit (DAU) ¹						Totals
	N. Eastern Calif.	NE Sierra	Cascade / N.Sierra	Central Sierra	Desert	Southern Sierra	
1952 High pop.	100,000	40,000	69,000	150,000	65,000	95,000	519,000
1952 High Density	9.8/ sq mi	11.1/sq mi	9.9/ sq mi	14.3/ sq mi	8.7/ sq mi	10.8/sq mi	11.6/sq mi (=0.018/ac)
1992 Ave. Pop.	25,000	10,000	40,000	70,000	11,500	35,000	191,500
1992 Average Density	2.5/ sq mi	3.1/ sq mi	7.9/ sq mi	6.7/ sq mi	1.5/ sq mi	4.0/ sq mi	4.3/ sq mi (=0.007/ac)

¹ These six DAUs total 28,732,160 acres (44,894 square miles).

These data indicate that mule deer continue to be present across the Sierra Nevada. Mule deer continue to be detected and bagged through hunting across the Sierra Nevada (Table MUDE-IV-1; CDFG 2007, CDFG 2010). Bucks and fawns continue to be detected within all Sierra Nevada DAUs and Hunt Zones and State buck ratio objectives continue to be met or exceeded within most hunt zones (Ibid).

MUDE Current population status and trend - California

MUDE California Conservation Status Mule deer is “S5- secure” (“demonstrably widespread, abundant, and secure”) in California (NatureServe 2007). It is listed as a Harvested species.

MUDE Current population status and trend – Range-wide

MUDE Range-wide Conservation Status. The Global and National conservation status of mule deer is “Secure” (“demonstrably widespread, abundant, and secure”) (NatureServe 2007).

MUDE-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in some herds or Deer Assessment Units, the distribution of mule deer populations in the Sierra Nevada is stable.

MUDE References Cited

CDFG (California Department of Fish and Game). 1998. An Assessment of Mule and Black-tailed Deer Habitats and Populations in California. Report to the Fish and Game Commission. February 1998. 57pp.

CDFG (Calif. Dept. Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

CDFG (California Department of Fish and Game). 2007. Deer Hunting Final Environmental Document, April 10, 2007. State of California, The Resources Agency, Department of Fish and Game. 80pp + appendices.

CDFG (California Department of Fish and Game). 2010. Data supplement to the California Fish and Game Commission regarding: Recommended 2010 Deer Tag Allocations (Updated 2009 Deer Harvest and Population Estimates). April 21, 2010. State of California, The Resources Agency, Department of Fish and Game. 34pp.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Patterson, B.D., G. Ceballos, W. Sechrest, M.F. Tognelli, T. Brooks, L. Luna, P. Ortega, I. Salazar, and B.E. Young. 2003. Digital Distribution Maps of the Mammals of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Bruce Patterson, Wes Sechrest, Marcelo Tognelli, Gerardo Ceballos, The Nature Conservancy-Migratory Bird Program, Conservation International-CABS, World Wildlife Fund-US, and Environment Canada-WILDSpace."

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. January 2001.

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

Northern Flying Squirrel (*Glaucomys sabrinus*) (NOFLS)

NOFLS-I. Overview of Species.

The northern flying squirrel (*Glaucomys sabrinus*) is the Management Indicator Species (MIS)) for late seral closed canopy coniferous forest habitat on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007a).

The northern flying squirrel occurs in northern North America, from Alaska through most of Canada, southward to the mountains of southern California, southern Rocky Mountains, western South Dakota, the Great Lakes, and the southern Appalachians (NatureServe 2007) (Figure NOFLS-I-1). In California, the northern flying squirrel is a locally common, yearlong resident of coniferous forests from 1500-2450 m elevation (5000-8000 ft) of the North Coast, Klamath, Cascade, Sierra Nevada Ranges, and the Warner Mountains (CDFG 2005) (Figure NOFLS-I-2).

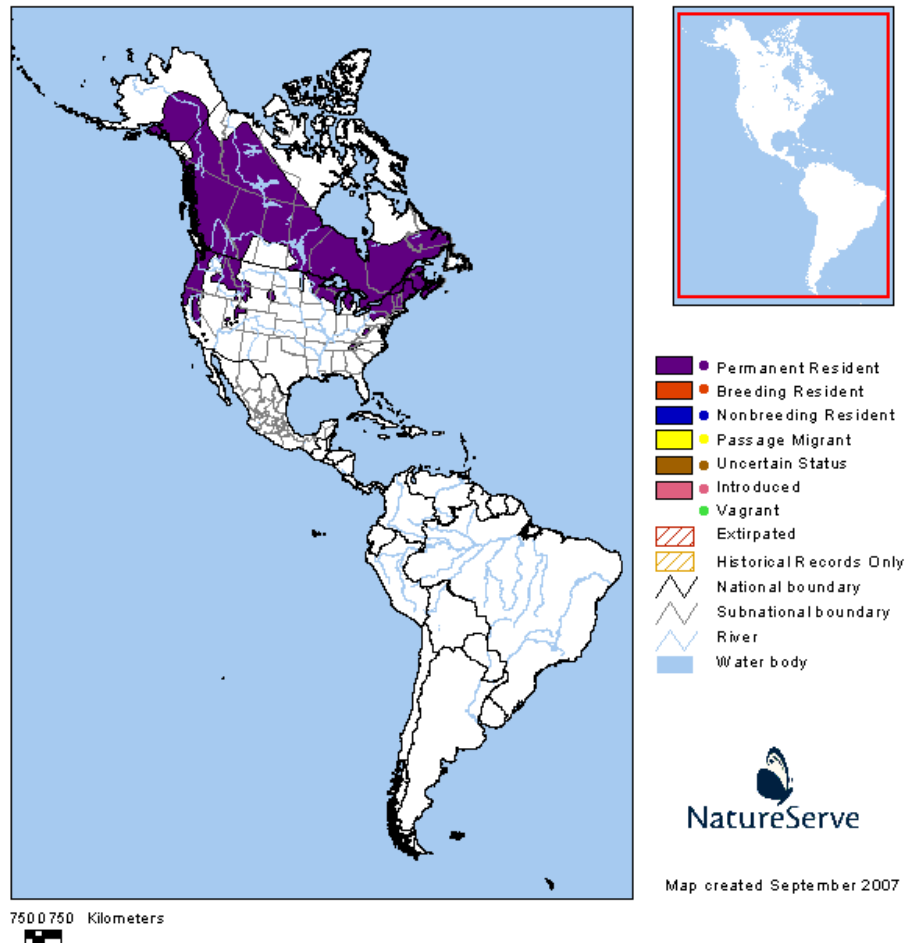


Figure NOFLS-I-1. Range-wide distribution of northern flying squirrel (Patterson et al. 2003 in NatureServe 2007).

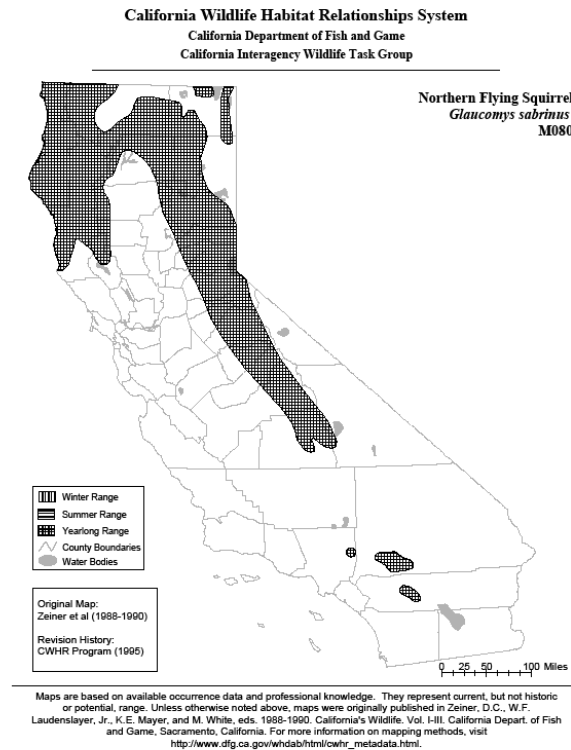


Figure NOFLS-I-2. Distribution of northern flying squirrel in California (CDFG 2005).

NOFLS-I.A. General Suitable Habitat. The northern flying squirrel occurs primarily in mature, dense conifer habitats intermixed with various riparian habitats, using cavities in mature trees, snags, or logs for cover (CDFG 2005).

Mean home range size based on 2004-2005 data from the Plumas National Forest was 25.7 ha; data from 2006 indicated average female home range size of between 12.55 ha (± 2.58) and 12.55 ha (± 5.67) (Sierra Nevada Research Center 2007). Average northern flying squirrel densities on the Lassen NF ranged from 0.31 squirrels per hectare to 3.29 squirrels per hectare (Waters and Zabel 1995).

NOFLS-I.B. Food Habits. Northern flying squirrels forage in trees and are omnivorous, eating seeds, nuts, and fruits of conifers, oaks, other trees, and shrubs, as well as lichens, fungi, arthropods, eggs, and birds (CDFG 2005). Truffles (hypogeous sporocarps of fungi) were common in the diet of northern flying squirrels in the northern Sierra Nevada (Waters and Zabel 1995, Waters et al. 2000).

NOFLS-I.C. Reproductive Habits. Usually 1 litter (1-6 young) per year is born in the spring, primarily in a cavity nest within a tree or snag (CDFG 2005). In the southern Sierra Nevada, nest trees were larger in diameter and taller than either random trees or

large (>50cm dbh) nearest-neighbor trees and snags were used more often than live trees relative to their availability (Meyer et al. 2005).

NOFLS-I.D. Risks and Management Concerns. Management concerns include loss of habitat, including snags, and predation by large owls, especially spotted owls, domestic cats, martens, fishers, bobcats, and long tailed weasels (CDFG 2005).

NOFLS-II. Habitat Relationships

The northern flying squirrel was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

NOFLS-III. Habitat Status and Trend.

Currently, there are 1,006,923 acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada (1,195,595 acres on all ownerships). The trend is slightly increasing: over the last two decades, late seral closed canopy coniferous forest habitat changed from comprising 7% of the National Forest System land acres in the Sierra Nevada to 9%; since the early 2000s, the trend has been stable at 9%. See the Habitat Monitoring Section of this Report for more detailed information.

NOFLS-IV. Population Status and Trend.

NOFLS Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007a). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

The northern flying squirrel has been monitored and surveyed in the Sierra Nevada at various sample locations by live-trapping, ear-tagging, radio-telemetry, camera surveys, and snap-trapping:

- 2002 to present - Plumas and Lassen National Forests (Sierra Nevada Research Center 2007, 2008, 2009, 2010).
- 1958 to 2004 - Monitoring and study efforts throughout the Sierra Nevada (Table NOFLS-IV-1).

Table NOFLS-IV-1. Summary of northern flying squirrel detections from studies in the Sierra Nevada.

Year(s)	Location	Reference
2003-2004	Northern Sierra Nevada (Plumas NF)	Coppeto et al. 2006
2002-2005	East-central Sierra Nevada (LTBMU)	USDA Forest Service 2007b
2000-2002	Southern Sierra Nevada (Sierra NF)	Meyer et al. 2005
1997-1998	East-central Sierra Nevada (LTBMU)	Pyare and Longland 2002
1994	Northern Sierra Nevada (Lassen NF)	Waters et al. 2000
1992-1993	Central Sierra Nevada (Tahoe NF and LTBMU)	Kucera and Barrett 1992
1991-1992	Northern Sierra Nevada (Lassen NF)	Waters and Zabel 1995
1990	Northern Sierra Nevada (Lassen NF)	Waters and Zabel 1995
1982-1983	Central Sierra Nevada (Tahoe NF)	Hall 1991
1958	Northern Sierra Nevada (Lassen County)	McKeever 1960

These data indicate that northern flying squirrels continue to be present at these samples sites.

NOFLS Current population status and trend - California

NOFLS California Conservation Status. The California conservation status of the northern flying squirrel is S5 (common, widespread, and abundant in the State) (NatureServe 2007).

NOFLS Current population status and trend – Range-wide

NOFLS Range-wide Conservation Status. The Global and National conservation status of the northern flying squirrel is G5-Secure (demonstrably widespread, abundant, and secure) and the National conservation status is N5 (common, widespread, and abundant in the nation) (NatureServe 2007).

NOFLS-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of northern flying squirrel populations in the Sierra Nevada is stable.

NOFLS References Cited

- CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).
- Coppeto, S.A., D.A. Kelt, D.H. Van Vuren, J.A. Wilson, and S. Bigelow. 2006. Habitat associations of small mammals at two spatial scales in the northern Sierra Nevada. *Journal of Mammalogy* 87(2):402-413.
- Hall, D.S. 1991. Diet of northern flying squirrel at Sagehen Creek, California. *Journal of Mammalogy* 72(3):615-617.
- Kucera, T.E., and R.H. Barrett. 1992. Cooperative wolverine study, second annual report, June 30, 1992. Dept. of Forestry and Resource Management, College of Natural Resources, University of California, Berkeley. Unpublished Report. 9pp + tables and appendices.
- Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.
- McKeever, S. 1960. Food of the northern flying squirrel in northeastern California. *Journal of Mammalogy* 41(2):270-271.
- Meyer, M.D., D.A. Kelt, and M.P. North. 2005. Nest trees of northern flying squirrels in the Sierra Nevada. *Journal of Mammalogy* 86(2):275-280.
- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).
- Patterson, B.D., G. Ceballos, W. Sechrest, M.F. Tognelli, T. Brooks, L. Luna, P. Ortega, I. Salazar, and B.E. Young. 2003. Digital Distribution Maps of the Mammals of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Bruce Patterson, Wes Sechrest, Marcelo Tognelli, Gerardo Ceballos, The Nature Conservancy-Migratory Bird Program, Conservation International-CABS, World Wildlife Fund-US, and Environment Canada-WILDSPACE."
- Pyare, S., and W.S. Longland. 2002. Interrelationships among northern flying squirrels, truffles, and microhabitat structure in Sierra Nevada old-growth habitat. *Can. J. For. Res.* 32:1016-1024.

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

Sierra Nevada Research Center. 2008. Plumas Lassen Study 2007 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 310pp.

http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2007.pdf

Sierra Nevada Research Center. 2009. Plumas Lassen Study 2008 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 223pp.

http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2008.pdf

Sierra Nevada Research Center. 2010. Plumas Lassen Study 2009 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 184pp.

http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2009.pdf

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA Forest Service. 2007b. Lake Tahoe Basin Management Unit Multi Species Inventory and Monitoring: A Foundation for Comprehensive Biological Status and Trend Monitoring in the Lake Tahoe Basin. Draft Report.

Waters, J.R., and C.J. Zabel. 1995. Northern flying squirrel densities in fir forests of northeastern California. *Journal of Wildlife Management* 59(4):858-866.

Waters, J.R., K.S. McKelvey, C.J. Zabel, and D. Luoma. 2000. Northern flying squirrel mycophagy and truffle production in fir forests in northeastern California. Pages 73-97 *in* USDA Forest Service Gen. Tech. Report PSW-GTR-178.

Pacific Treefrog (Pacific Chorus Frog) (*Pseudacris regilla*) (PATR)

PATR-I. Overview of Species.

The Pacific treefrog (*Pseudacris regilla*), now known as the Pacific Chorus Frog, is the Management Indicator Species (MIS) for wet meadow habitat on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007a).

The Pacific treefrog occurs in western North America, from southern British Columbia in Canada southward through the United States to southern Baja California, Mexico, and east to Montana, Idaho, and Nevada (NatureServe 2007) (Figure PATR-I-1). In California, it occurs throughout the state except for the southeastern portion (CDFS 2005) (Figure PATR-I-2).

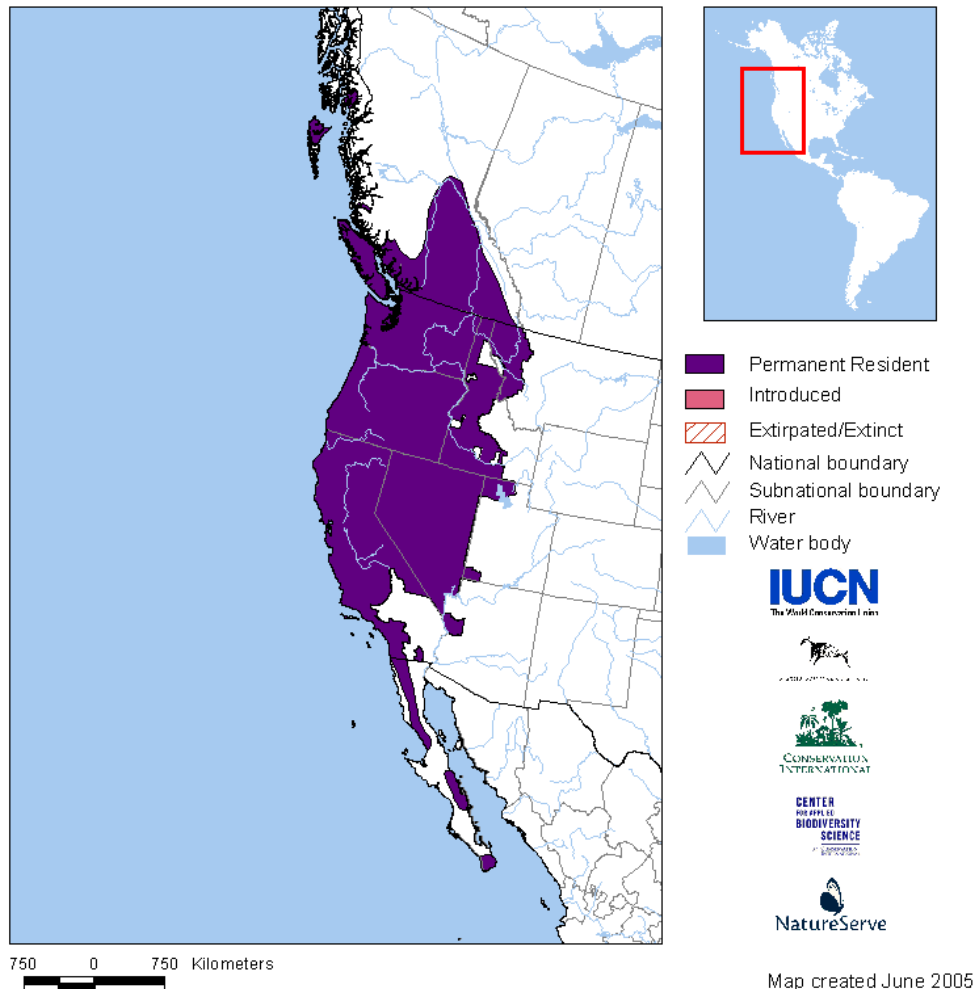


Figure PATR-I-1. Range-wide distribution of Pacific treefrog (NatureServe 2007).

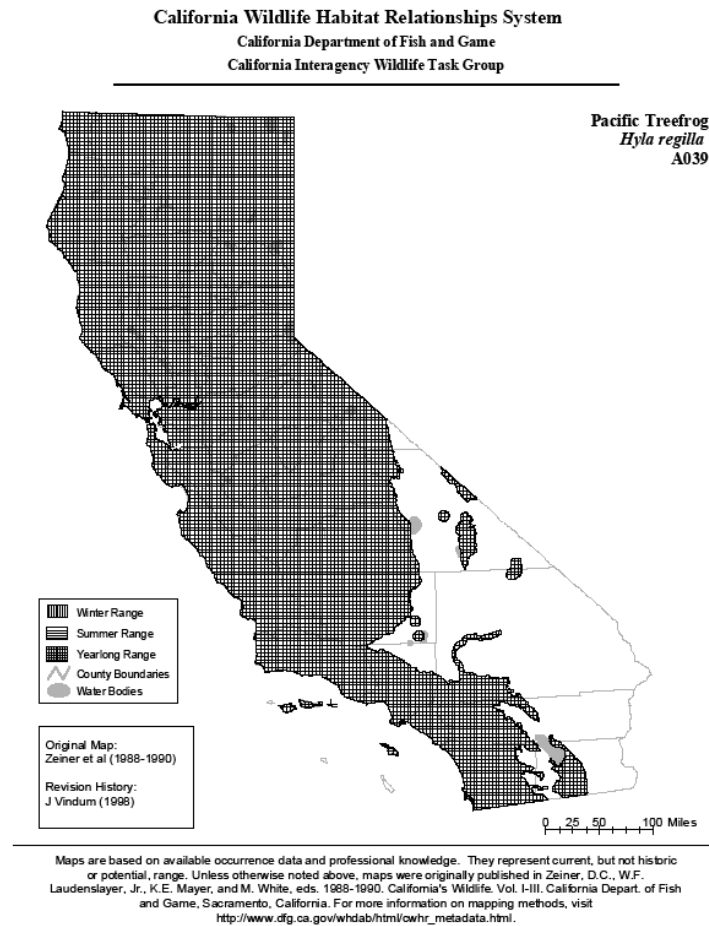


Figure PATR-I-2. Distribution of Pacific treefrog in California (CDFG 2005).

PATR-I.A. General Suitable Habitat. This broadly distributed species requires standing water for breeding; tadpoles require standing water for periods long enough to compete aquatic development, which can be as long as 3 or more months at high elevations in the Sierra Nevada (CDFG 2005). During the day during the breeding season, adults take cover under clumps of vegetation and surface objects near water; during the remainder of the year, they leave their breeding sites and seek cover in moist niches in buildings, wells, rotting logs or burrows (ibid).

PATR-I.B. Food Habits. Pacific treefrogs eat a variety of invertebrates, including larval and adult forms of slugs, spiders, isopods, centipedes, earthworms, and insects (CDFG 2005).

PATR-I.C. Reproductive Habits. Reproduction occurs for a few weeks sometime between January and July, and the female deposits numerous small clusters of eggs anchored to the stems of submerged or emergent vegetation within a quite, shallow water

body (CDFG 2005). Eggs hatch in 1-5 weeks and tadpoles may reach up to 1.8 inches before metamorphizing (Ibid).

PATR-I.D. Risks and Management Concerns. Pacific treefrog adults and tadpoles are preyed upon by introduced fish, bullfrogs, garter snakes, birds, and some nocturnal mammals (CDFG 2005, NatureServe 2007).

PATR-II. Habitat Relationships

The Pacific treefrog was selected as an MIS for wet meadow habitat in the Sierra Nevada. This habitat is comprised primarily of a variety of herbaceous plants in areas where water is at or near the surface most of the growing season (Mayer and Laudenslayer 1988). Detailed descriptions of wet meadow habitat can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

PATR-III. Habitat Status and Trend.

There are currently 61,247 acres of wet meadow habitat on National Forest System lands in the Sierra Nevada. The trend is stable. See the Habitat Monitoring Section of this Report for more detailed information.

Meadow condition is also monitored through the R5 Range Monitoring Project (Weixelman 2007). A total of 822 permanent plots have been established in Region 5 since 1999. The condition of 551 meadow plots and 126 greenline plots have been calculated, indicating that a majority (59%) of the key monitoring sites in meadows are in moderate ecological condition, 19% are in high condition, and 23% are in low condition (note that key sites were selected to reflect current management and trend and are not selected to represent the general condition of meadows across Region 5) (Weixelmann 2007). In addition, 5-year trend has been calculated for 323 meadow plots. These results indicate that 58% of the sites are stable (i.e. no trend), while 22% are in an upward trend, and 20% are in a downward trend. A total of 126 greenline plots have been established since 1999. A majority of these (56%) 28 are at a late successional stage or at Potential Natural Community (PNC) (i.e., in good condition). A total of 64 greenlines around Region 5 have been measured for 5-year trend and 48% are in an upward trend while 20% are in a downward trend.

PATR-IV. Population Status and Trend.

PATR Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007a). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

Since 2002, the Pacific treefrog has been monitored on the Sierra Nevada forests as part of the Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan (USDA Forest Service 2005, 2006, 2007b, 2009, 2010). The Sierra Nevada Amphibian Monitoring

Program (SNAMPH) is designed to assess the status and change in occupancy of two frog species, Yosemite toad (*Bufo canorus*) and mountain yellow-legged frog (*Rana muscosa*); the program also collects data for all amphibians and reptiles observed, including the Pacific treefrog (*Pseudacris regilla*). The SNAMPH conducts visual encounter surveys (VES), focusing on detecting tadpoles, within a subset of small watersheds (2-4 km²) selected throughout the range of each target species (Yosemite toad and mountain yellow-legged frog); most are surveyed once over a 5-year cycle and 20% are revisited annually. The monitoring program was pilot tested in 2002 and 132 sample watersheds have been surveyed at least once through 2007. Twenty-six watersheds have been surveyed at least 4 consecutive years.

Using these data, preliminary occupancy estimates for the Pacific treefrog were calculated as simple summaries of the sample collected from 2002-2007 (Tables PATR-IV-1 and PATR-IV-2). Table PATR-IV-1 summarizes the numbers and percent of occupied basins for each year and for the total sample. The latter summarizes the number of basins occupied at least once during the period 2002-2007. Table PATR-IV-2 summarizes the annual variability of occupancy based on the 26 basins sampled every year (Brown 2008).

Analyses to estimate Pacific treefrog occupancy throughout the study area are not completed. For the analysis, occupancy was assigned to three mutually exclusive categories. Breeding watersheds are those where tadpoles, egg masses, or metamorphs were found; adults/subadults are those where treefrogs were found but no signs of breeding; and not found are those where no treefrogs were found. Treefrog adults and subadults are generally nocturnal and not reliably found during daytime surveys (Brown 2008).

The following caveats apply to these estimates: (1) the area of inference for the monitoring program are the ranges of the two target species in the Sierra Nevada, not the range of the Pacific treefrog [the range of the mountain yellow-legged frog encompasses the majority of the treefrog's range in the Sierra Nevada]; and (2) the sample is weighted to ensure detection of the two target species, not the Pacific treefrog and this has not yet been adjusted for (however, since the treefrog is commonly found in the same areas as the two target species within the study area, this is not likely to be a major bias) (Brown 2008).

Almost 70% of sample watersheds were occupied by Pacific treefrog breeding at least once during the period of 2002-2007 (Table PATR-IV-1). An additional 7.6% were occupied by adults or subadults with no signs of breeding, and 25% had no treefrogs. Breeding occupancy by year was similar ranging from 54% during 2007 (a dry year) to 78% in 2002. Most of the annual re-survey basins (67%) were occupied most years surveyed (every year or missing only 1 year), 11% were not occupied more than 1 year, and 22% had no treefrogs any of the years surveyed.

Data from 2008 found occupancy for this species to be high (USDA Forest Service 2010). Of the 108 historically occupied watersheds, 86 (79.6%) were occupied by

breeding, and 88 (81.5%) by any stage. Adult chorus frogs are not commonly found outside of spring breeding. In the unknown watersheds, 41.7% (n=20) were occupied by breeding, and 50% (n=24) were occupied by any stage. Nineteen of the 26 watersheds surveyed every year were occupied by breeding. Fourteen of these were occupied most of the years they were surveyed.

These data indicate that Pacific treefrogs continue to be present at these sample sites.

Table PATR IV-1. Number of basins in sample occupied by Pacific treefrogs, 2002-2007.

Sierra Nevada Amphibian Monitoring Program DRAFT									
Table 1. Number of Basins in Sample Occupied by Pacific Treefrogs (<i>Pseudacris regilla</i>) 2002-2007. Note: These data summarize the sample; inferences to the study area are not completed.									
	# Basins Total	Breed		Adult/Subadult		Any Life Stage		Not Found	
		N	%	N	%	N	%	N	%
Occupied at least one year	132	89	67.4	10	7.6	99	75.0	33	25.0
By Year									
2002	9	7	77.8	0	0.0	7	77.8	2	22.2
2003	36	22	61.1	2	5.6	24	66.7	12	33.3
2004	51	32	62.7	5	9.8	37	72.5	14	27.5
2005	46	32	69.6	1	2.2	33	71.7	13	28.3
2006	40	29	72.5	1	2.5	30	75.0	10	25.0
2007	54	29	53.7	5	9.3	34	63.0	20	37.0

Table PATR-IV-2. Annual variability for basins surveyed every year.

Sierra Nevada Amphibian Monitoring Program DRAFT		
Table 2. Annual Variability for Basins Surveyed Every Year.		
	N	%
Total # Basins	27	100.0
# Basins with Occupancy Every Year	11	40.7
# Basins with Occupancy All But 1 year	7	25.9
# Basins Not Occupied >1 year	3	11.1
# Basins with None Found	6	22.2

PATR Current population status and trend - California

PATR California Conservation Status. The California conservation status of the Pacific treefrog is S5 (common, widespread, and abundant in the State) (NatureServe 2007).

PATR Current population status and trend – Range-wide

PATR Range-wide Conservation Status. The Global and National conservation status of the Pacific treefrog is G5-Secure (demonstrably widespread, abundant, and secure) and the National conservation status is N5 (common, widespread, and abundant in the nation) (NatureServe 2007).

PATR-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of Pacific treefrog populations in the Sierra Nevada is stable.

PATR References Cited

Brown, C. 2008. Summary of Pacific Treefrog (*Pseudacris regilla*) Occupancy in the Sierra Nevada within the range of the Mountain Yellow-legged Frog (*Rana muscosa*). Sierra Nevada Amphibian Monitoring Program draft assessment, January 18, 2008.

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version.
<http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available
<http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

USDA Forest Service. 2005. Sierra Nevada forest plan accomplishment monitoring report for 2004. USDA Forest Service, Pacific Southwest Region R5-MR-026. 8pp.

USDA Forest Service. 2006. Sierra Nevada forest plan accomplishment monitoring report for 2005. USDA Forest Service, Pacific Southwest Region R5-MR-000. 12pp.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA Forest Service. 2007b. Sierra Nevada forest plan accomplishment monitoring report for 2006. USDA Forest Service, Pacific Southwest Region R5-MR-149. 12pp.

USDA Forest Service. 2009. Sierra Nevada forest plan accomplishment monitoring report for 2007. USDA Forest Service, Pacific Southwest Region. On-line version. <http://www.fs.fed.us/r5/snfpa/monitoringreport2007/>

USDA Forest Service. 2010. Sierra Nevada forest plan accomplishment monitoring report for 2008. USDA Forest Service, Pacific Southwest Region. On-line version. <http://www.fs.fed.us/r5/snfpa/monitoringreport2008/amphibian/page2.php>

Weixelman, D. 2007. USFS Region 5 Range Monitoring Project 2006 Report. Unpublished Report. Range Ecology, U.S. Forest Service, Nevada City, CA. April 27, 2007. 35pp.

Sooty (Blue) Grouse (*Dendragapus obscurus* or *D. fuliginosus*) (SOGR)**SOGR-I. Overview of Species.**

The sooty grouse, which used to be known as the blue grouse, is the Management Indicator Species (MIS) for late seral open canopy coniferous forest habitat on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007a).

The blue grouse (*Dendragapus obscurus*) was recently split taxonomically into dusky grouse (*D. obscurus*) in the Rocky Mountain and Great Basin Ranges and sooty grouse (*D. fuliginosus*) in the Pacific coastal regions (Banks et al. 2006). In California, the sooty grouse is an uncommon to common permanent resident at middle to high elevations within the North Coast Ranges in northwestern California, and the Klamath, Sierra Nevada, and portions of the Warner, White, and Tehachapi Mountains (CDFG 2005) (Figure SOGR-I-1). Sierra sooty grouse (*D. f. sierrae*) occurs in the Cascade Mountains from central Washington south, continuing south into the Sierra Nevada Mountains as far as Kings River, and in the Warner Mountains, White Mountains, and Trinity-Siskiyou Ranges (Bland 2008). The Mt. Pinos sooty grouse (*D. f. howardi*) occurs in the Sierra Nevada Mountains south of Kings River, and historically as far south as the vicinity of Mount Pinos (Kern Co.); however, it is thought to be extirpated south of Kern Gap (Ibid) (Figure SOGR-I.1).

SOGR-I.A. General Suitable Habitat. Sooty grouse occurs in open, medium to mature-aged stands of fir, Douglas-fir, and other conifer habitats, interspersed with medium-to-large openings and available water (CDFG 2005). Empirical data from the Sierra Nevada indicate that Sooty Grouse hooting sites are located in open, mature, fir-dominated forest, where particularly large trees are present (Bland 2006).

Territory size varies throughout species range from 1.2 to 4.5 ha (3-11 ac); summer home ranges of broods varied from 12.5 to 115 ha (31-283 ac) in Montana (CDFG 2005). Bland (1997) estimated densities of hooting males in the southern Sierra Nevada to range from 0.4 to 3.0 males per 100 hectares (0.1-1.2/100ac).

SOGR-I.B. Food Habits. Sooty grouse pluck on shrubs, grasses and plants for seeds and insects from the ground and in the tree canopy; their winter diet largely includes needles, buds, cones, and twigs in conifer stands, and their summer diet also includes insects, land snails, grasshoppers, and spiders (CDFG 2005). Chicks feed primarily on arthropods (Ibid).

SOGR-I.C. Reproductive Habits. Sooty grouse breed from early April to late August, with 6-8 eggs hatching from a ground nest (built under logs, stumps, and snags) in late May to mid-June (CDFG 2005).

SOGR-I.D. Risks and Management Concerns. Heavy grazing, newly cut forests for timber, stands being treated for fuels reduction, and repeated long term burning may

impact populations (CDFG 2005). Predators are golden and bald eagle, red-tailed hawk, northern goshawk, Cooper's hawk, great horned owl, *Corvus* spp., badger, black bear, cougar, coyote, striped skunk, ground squirrel, and long-tailed weasel (Ibid).

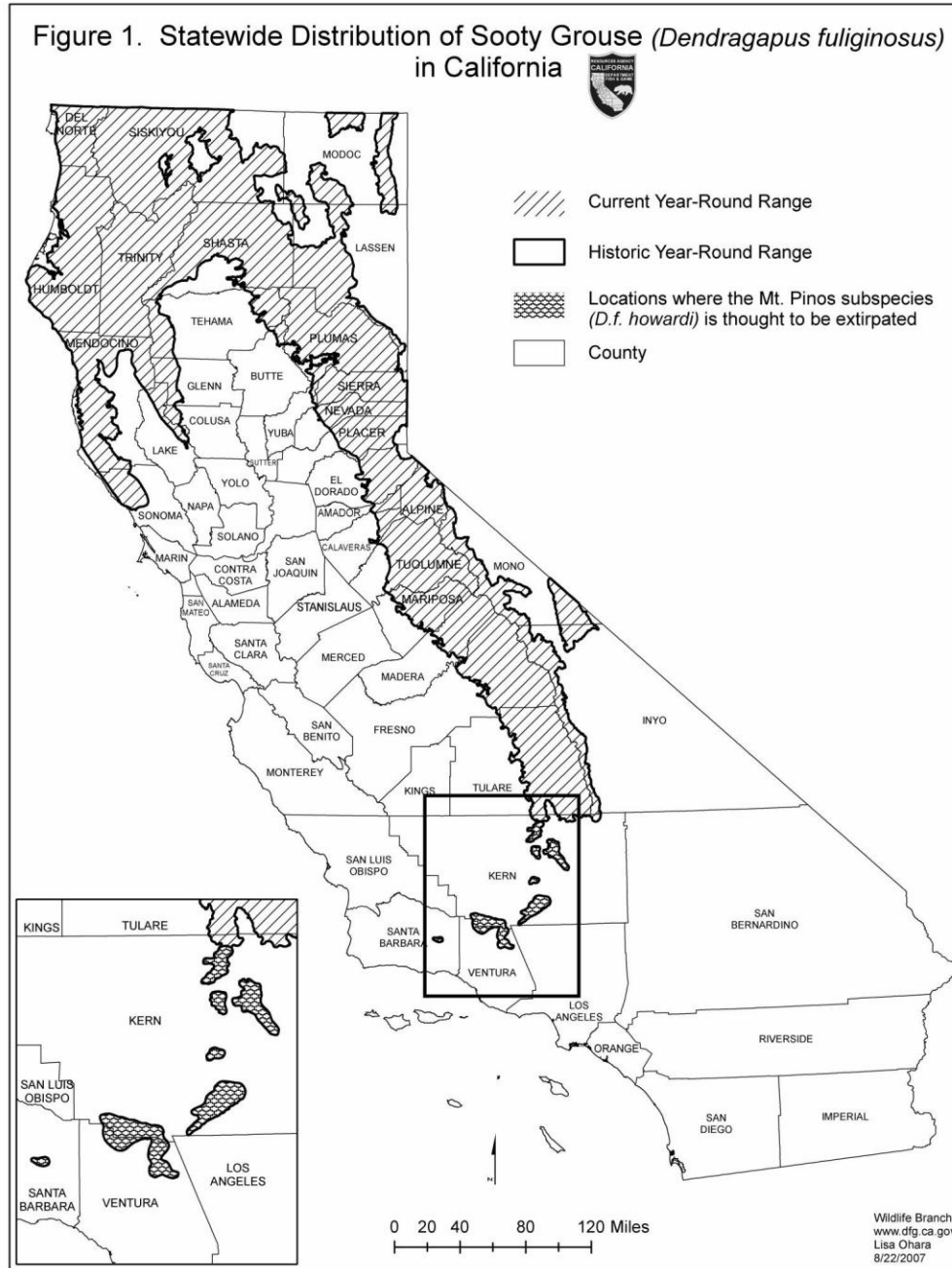


Figure SOGR-I-1. Distribution of sooty (blue) grouse in California (Bland 2008 referencing CDFG with permission).

SOGR-II. Habitat Relationships

The sooty grouse was selected as the MIS for later seral open canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures less than 40%. Detailed descriptions of these types can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

SOGR-III. Habitat Status and Trend.

There are currently 63,795 acres of late seral open canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat on National Forest System lands in the Sierra Nevada. The trend is slightly decreasing; over the last two decades, late seral open canopy coniferous forest habitat changed from comprising 3% of the National Forest System land acres in the Sierra Nevada to 1%. See the Habitat Monitoring Section of this Report for more detailed information.

SOGR-IV. Population Status and Trend.***SOGR Current population status and trend – Sierra Nevada***

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007a). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

The sooty grouse has been monitored in the Sierra Nevada at various sample locations by hunter survey, modeling, and point counts, breeding bird survey protocols:

- California Department of Fish and Game Blue (Sooty) Grouse Surveys (Bland 1993, 1997, 2002, 2006).
- California Department of Fish and Game hunter survey, modeling, and hunting regulations assessment (CDFG 2004a, CDFG 2004b)
- Multi-species inventory and monitoring on the Lake Tahoe Basin Management Unit (LTBMU 2007).
- 1968 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007).

These data indicate that sooty grouse continue to be present across the Sierra Nevada, except in the area south of the Kern Gap, where they are apparently absent (Bland 2008 referencing Bland *in press*). Sooty (blue) grouse continue to be detected and bagged through hunting across the Sierra Nevada (CDFG 2004b). In addition, modeling based on game take survey and habitat acres indicates that the spring breeding population can more

than sustain the total annual mortality, including hunting mortality (CDFG 2004a). Blue or sooty grouse have continued to be detected on BBS routes in the Sierra Nevada (Sauer et al. 2007). As of 1999, BBS data indicate an increasing tendency (Siegel and DeSante 1999).

SOGR Current population status and trend - California

SOGR California Conservation Status. Sooty grouse is “not ranked, under review” in California (NatureServe 2007). It is listed as a Harvested species. In 2004, Statewide, the spring population of sooty (blue) grouse was estimated to be from 5,737,161 to 10,593,333 birds (CDFG 2004a).

SOGR California Population Trend Index. BBS trend for California from 1968-2005 is 12.4, range -4.5 to 29.2 ($p=0.18$, $N=15$) with a regional credibility ranking of red (data with an important deficiency) (Sauer et al. 2007). Data between 1966 and 2002 show an increasing trend in the spring breeding population (trend 9.61, $p=0.32$, $n=16$) (CDFG 2004a).

SOGR Current population status and trend – Range-wide

SOGR Range-wide Conservation Status. The Global and National conservation status of the sooty grouse is “Secure” (“demonstrably widespread, abundant, and secure”) (NatureServe 2007).

SOGR Range-wide Population Trend Index. BBS trend for the United States from 1968-2006 is -0.6, range -2.9 to 3.6 ($p=0.76$, $N=75$) with a regional credibility ranking of yellow (data with a deficiency). Survey-wide BBS trend for the same period is -2.3, range -3.7 to -0.9 ($p=0.00$, $N=111$), also with a yellow regional credibility ranking (Sauer et al. 2007).

SOGR-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the population distribution for the sooty grouse for the Sierra Nevada north of the Kern Gap is stable.

SOGR References Cited

Banks, R.C., C. Cicero, J.L. Dunn, A.W. Kratter, P.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising, and D.F. Stotz. 2006. Forty-seventh supplement to the American Ornithologists' Union Checklist of North American Birds. *Auk* 123:926-936.

- Bland, J.D. 1993. Forest grouse and mountain quail investigations: A final report for work completed during the summer of 1992. Unpubl. report, Wildl. Mgmt. Div., Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA.
- Bland, J.D. 1997. Biogeography and conservation of blue grouse *Dendragapus obscurus* in California. *Wildlife Biology* 3(3/4):270.
- Bland, J. D. 2002. Surveys of Mount Pinos Blue Grouse in Kern County, California, Spring 2002. Unpubl. report, Wildl. Mgmt. Div., Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.
- Bland, J.D. 2006. Features of the Forest Canopy at Sierra Sooty Grouse Courtship Sites. Unpubl. report (Contract S0680003), Wildl. Mgmt. Div., Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA.
- Bland, J.D. 2008. Draft survey protocol for sooty grouse in the Sierra Nevada Mountains of California. Draft Unpublished Report, Prepared for USDA Forest Service, Pacific Southwest Region. January 2008. 50pp.
- CDFG (Calif. Dept. Fish and Game). 2004a. Resident Game Bird Hunting Final Environmental Document. August 5, 2004. State of California, The Resources Agency, Department of Fish and Game. 182 pp + appendices.
- CDFG (Calif. Dept. Fish and Game). 2004b. Report of the 2004 Game Take Hunter Survey. State of California, The Resources Agency, Department of Fish and Game. 20pp.
- CDFG (Calif. Dept. Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).
- Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.
- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).
- Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. [USGS Patuxent Wildlife Research Center](http://www.pwrc.usgs.gov/bbs/), Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight. Available on-line: <http://www.prbo.org/calpif/htmldocs/sierra.html>.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA Forest Service. 2007b. Lake Tahoe Basin Management Unit Multi Species Inventory and Monitoring: A Foundation for Comprehensive Biological Status and Trend Monitoring in the Lake Tahoe Basin. Draft Report.

Yellow Warbler (*Dendroica petchia*) (YEWA)

YEWA-I. Overview of Species.

The Yellow warbler (*Dendroica petchia*) is the Management Indicator Species (MIS) for riparian habitat on the ten Sierra Nevada national forests (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) (USDA Forest Service 2007).

The yellow warbler breeds from northern Alaska across northern Canada to Labrador, south to Panama and through West Indies to northern coast of South America, and winters in southern California, southern Arizona, northern Mexico, and southern Florida south to central Peru, northern Bolivia, and Amazonian Brazil (NatureServe 2007) (Figure YEWA-I-1). In California, the yellow warbler breeds from the coast range in Del Norte county, east to Modoc plateau, south along coast range to Santa Barbara and Ventura counties and along western slope of Sierra Nevada south to Kern county; it also breeds along eastern side of California, from the Lake Tahoe area south through Inyo County and in several southern California mountain ranges and throughout most of San Diego County (CDFG 2005) (Figure YEWA-I-2).

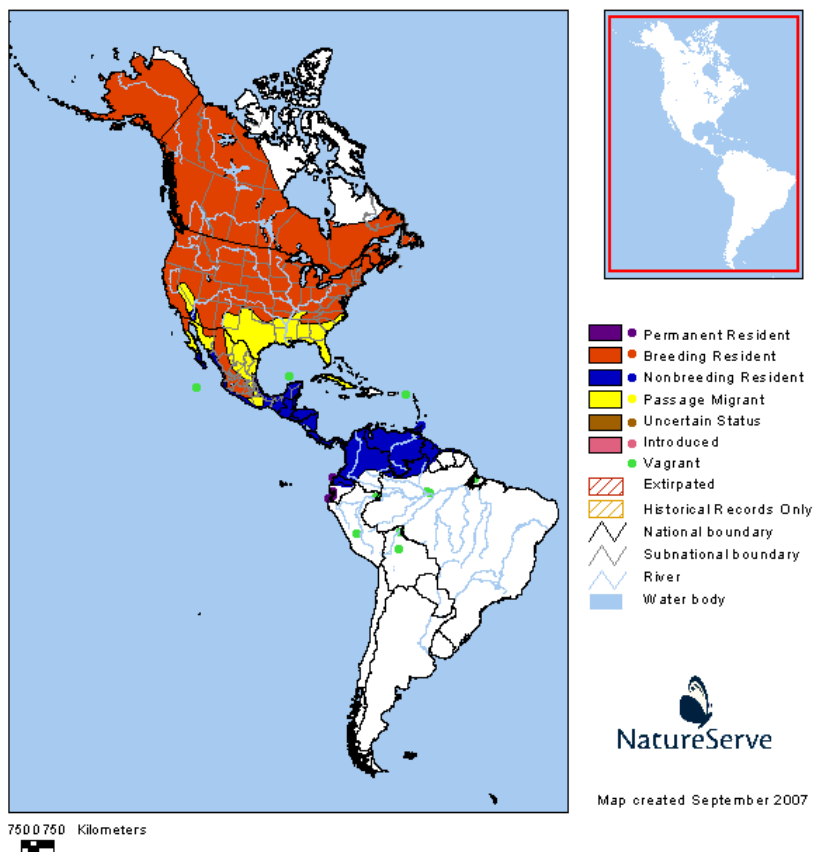


Figure YEWA-I-1. Range-wide distribution of yellow warbler (Ridgely et al. 2003 in NatureServe 2007).

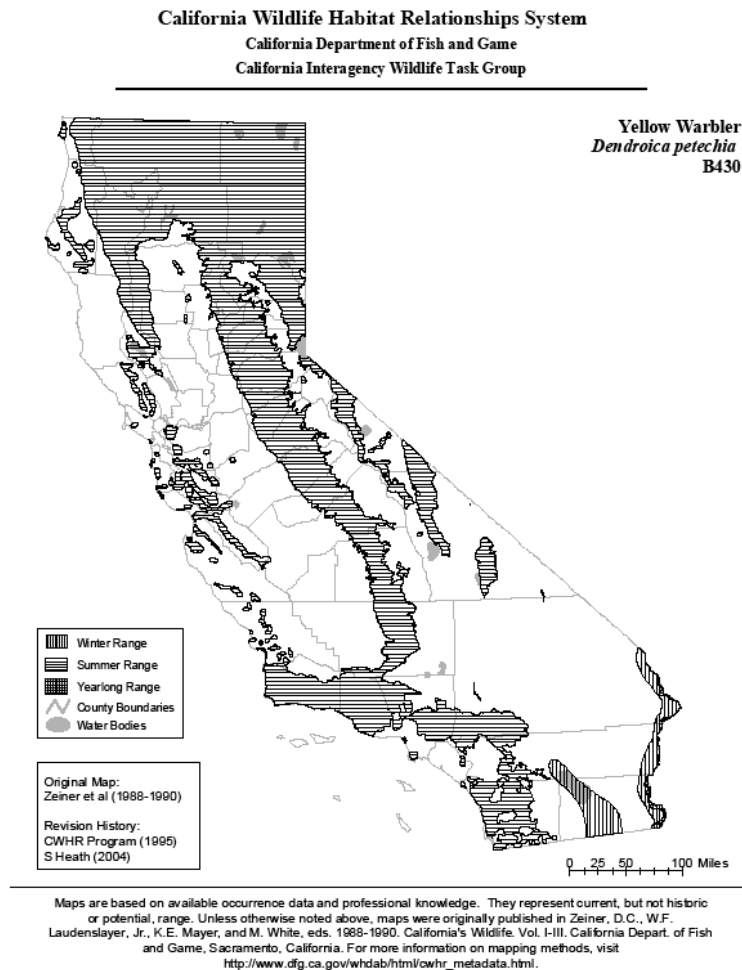


Figure YEWA-I-2. Distribution of yellow warbler in California (CDFG 2005).

YEWA-1.A. General Suitable Habitat. This species is usually found in riparian deciduous habitats in summer (cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland) (CDFG 2005). Yellow warbler is dependent on both meadow and non-meadow riparian habitat in the Sierra Nevada (Siegel and DeSante 1999).

YEWA-1.B. Food Habits. This species mostly eats insects and spiders by gleaning and hovering in the upper canopy of deciduous trees and shrubs (CDFG 2005).

YEWA-1.C. Reproductive Habits. The yellow warbler builds its nest in the midstory, often in deciduous riparian plant species, such as willows and cottonwoods, but also breeds locally in wild rose and more xeric plant species and habitats (Siegel and DeSante 1999). Breeding grounds are generally found in wet areas with early successional riparian communities, or regenerating canopy species stands (Ibid). Breeding occurs from mid-April into early August, and 3-6 eggs are laid in an open cup nest placed 0.6 to 5 m (2-16 ft) above ground in a deciduous sapling or shrub (CDFG 2005).

YEWA-1.D. Risks and Management Concerns. The yellow warbler is subject to predation by small mammals, accipiters, corvids, and snakes (CDFG 2005). Brood parasitism by brown-headed cowbirds is heavy and apparently has been a major cause of the drastic decline in numbers in lowland localities in recent decades (Ibid). Grazing reduces quality of nesting habitat (Siegel and DeSante 1991). Yellow warblers seem to respond quickly to management actions such as restoration and brown-headed cowbird control (Ibid).

YEWA-II. Habitat Relationships

The yellow warbler was selected as the MIS for riparian habitat (CWHR types montane riparian (MRI) and valley foothill riparian (VRI)) in the Sierra Nevada. Detailed descriptions of this habitat can be found in CDFG (2005) and Mayer and Laudenslayer (1988). The crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is found in Appendix B.

YEWA-III. Habitat Status and Trend.

There are currently 38,140 acres of riparian habitat on National Forest System lands in the Sierra Nevada. Within the last two decades, the trend is stable. See the Habitat Monitoring Section of this Report for more detailed information.

YEWA-IV. Population Status and Trend.

YEWA Current population status and trend – Sierra Nevada

The population monitoring strategy for this MIS is distribution population monitoring (USDA Forest Service 2007). Distribution population monitoring tracks the changes in the distribution of each MIS at the Sierra Nevada scale by monitoring the changes in the presence of the species across a number of sample locations.

Monitoring of mountain quail (*Oreortyx pictus*), Hairy Woodpecker (*Picoides villosus*), Fox Sparrow (*Passerella iliaca*), and Yellow Warbler (*Dendroica petechia*) across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science. The sampling protocol and data collected can be found at: <http://data.prbo.org/partners/usfs/snmis/>. The 2009 and 2010 results for are summarized below.

In each year, 500 upland transects were targeted. In 2009, 50 riparian transects were targeted; in 2010, this was increased to 100. The number of transects (cluster of four or five point count stations) visited each year are listed in Table FOSP-1 (see the Fox Sparrow account).

The monitoring results are displayed in Table FOSP-2 (see the Fox Sparrow account), including the number of individuals recorded and MIS prevalence on points and transects. The number of sites visited increased from 2009 to 2010 for all the samples

due to larger field crew size (15 in 2010 vs 12 in 2009), and the number of individuals and number of survey locations where species were encountered increased correspondingly. In most cases, the proportion of survey locations where MIS were recorded also increased from 2009 to 2010.

Table FOSP-3 (see the Fox Sparrow account) lists the average abundance per point count of all individuals within 100m by forest for 2009 and 2010 and for both the upland (Fox Sparrow, Mountain Quail, and Hairy Woodpecker) and riparian (Yellow Warbler) samples. Note that only about 50% of the sites used in this analysis were surveyed in both years. In addition, using only records up to 100m estimated distance from observer about 80% of all Mountain Quail records.

In addition, the yellow warbler has been monitored and surveyed in the Sierra Nevada at various sample locations by avian point counts and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008).

YEWA Current population status and trend - California

YEWA California Conservation Status. Yellow warbler is “not ranked, under review” in California (NatureServe 2007).

YEWA California Population Trend Index. BBS trend for California from 1968-2005 is -1.3, range -2.1 to 0.5 ($p=0.17$, $N=128$) with a regional credibility ranking of blue (data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes) (Sauer et al. 2007).

YEWA Current population status and trend – Range-wide

YEWA Range-wide Conservation Status. The Global and National conservation status of the yellow warbler is “Secure” (“demonstrably widespread, abundant, and secure”) (NatureServe 2007). The Global Short-term trend comments indicate that yellow warbler is declining in several areas in the U.S., most seriously in California and Arizona (NatureServe 2007 referencing Ehrlich et al. 1992); Breeding Bird Survey data indicate a significant population increase in eastern North America, 1966-1988 and 1978-1988; a significant decrease in central North America, 1966-1988; and a significant increase in western North America, 1978-1988 (NatureServe 2007 referencing Sauer and Droege 1992).

YEWA Range-wide Population Trend Index. BBS trend for the United States from 1968-2006 is 0.2, range -0.1 to 0.6 ($p=0.13$, $N=2041$) with a regional credibility ranking of blue (data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes). Survey-wide BBS trend for the same period is 0.1, range

-0.2 to 0.3 ($p=0.47$, $N=2641$), also with a blue regional credibility ranking (Sauer et al. 2007).

YEWA-V. Population Status and Trend Summary for the Sierra Nevada National Forests

Current data at the rangewide, California, and Sierra Nevada scales indicate that the population distribution for the yellow warbler in the Sierra Nevada is stable.

YEWA References Cited

CDFG 2005 (California Department of Fish and Game. California Interagency Wildlife Task Group. 2005). California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Heath, S. K., and Ballard, G. 2003. Bird species composition, phenology, nesting substrate and productivity for the Owens Valley alluvial fan, eastern Sierra Nevada, California 1998-2002. *Great Basin Birds* 6: 18-35.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. *A Guide to Wildlife Habitats of California*. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 2, 2008).

Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2003. Digital Distribution Maps of the Birds of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. "Data provided by NatureServe in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSPACE."

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. USGS Patuxent Wildlife Research Center, Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

USDA Forest Service. 2007. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

APPENDIX A

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS (CWHR) SYSTEM

Reference: CDFG 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. 2005. California Wildlife Habitat Relationships version 8.1 personal computer program. Sacramento, California. On-Line version.

<http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>.

CWHR Overview. The California Wildlife Habitat Relationship (CWHR) is a wildlife information system and predictive model for California's regularly-occurring birds, mammals, reptiles and amphibians and is considered “a state-of-the-art information system for California's wildlife.” It contains life history, geographic range, habitat relationships, and management information on 692 species of amphibians, reptiles, birds, and mammals known to occur in the state. It provides the most widely used habitat relationships models for California's terrestrial vertebrate species. CWHR is operated and maintained by the California Department of Fish and Game in cooperation with the California Interagency Wildlife Task Group (CIWTG). CWHR Version 8.1 is used in the terrestrial MIS Accounts.

CWHR contains the following components:

- a complete species list of California's 1000+ terrestrial vertebrates;
- life history information and geographic range data by season on 692 regularly-occurring species;
- a standardized habitat classification scheme for California, containing 59 habitats, structural stages for most habitats, and 124 special habitat elements (*A Guide to Wildlife Habitats of California (1988); Edited by Kenneth E. Mayer and William F. Laudenslayer, Jr., State of California, Resources Agency, Department of Fish and Game. Sacramento, CA. 166 pp.*)
- a community-level matrix model associating 692 wildlife species to these standard habitats and stages and rating suitability for reproduction, cover, and feeding;
- A software application containing all system components.

CWHR Utility. CWHR has been used for several large wildlife resource conservation efforts including California's GAP effort, the Legislatively-authorized Timberland Task Force effort, and the Sierra Nevada Framework and Forest Plan Amendment efforts. It is one of the primary biological data sets used in an assessment of California's biodiversity for the “Atlas of the Biodiversity of California.” CWHR is used in sustained yield planning efforts by several large private timber companies and is part of regulations adopted by the California Board of Forestry.

CWHR Validation. The information in CWHR is based on current published and unpublished biological information and professional judgment by recognized experts on California's wildlife. Research to improve the CWHR System is ongoing and is focused

in the areas of model and validation standards, field validation studies, and interpretation of model output. Some examples of these studies are presented below.

Model and Validation Standards

Barrett, R.H. and M. White (authors) and M. Parisi (editor). 1999. Guide for Designing Field Validation Studies of the California Wildlife Habitat Relationships System. Technical Report No. 30. California Wildlife Habitat Relationships System, California Department of Fish and Game. Sacramento, CA.

California Department of Fish and Game and California Interagency Wildlife Task Group. 2000. Standards and Guidelines for CWHR Species Models. Technical Report No. 31. California Wildlife Habitat Relationships System, California Department of Fish and Game. Sacramento, CA.

Field Validation Studies of CWHR Predictions

Avery, M.L. and C. Van Riper. 1990. Evaluation of wildlife-habitat relationships data base for predicting bird community composition in central California chaparral and blue oak woodlands. *California Fish and Game* 76(2):103-117.

Baad, M.F. 1992. Plant and Wildlife Resources Inventory of Boggs Mountain Demonstration State Forest, Lake County, California. Unpublished Report. California State University, Sacramento. Sacramento, CA. 69 pp.

Block, W.M., M.L. Morrison, J. Verner, and P.N. Manley. 1994. Assessing wildlife-habitat-relationships models: a case study with California oak woodlands. *Wildlife Society Bulletin* 22:549-561.

Dedon, M.F., S. A. Laymon, and R.H. Barrett. 1986. Evaluating models of wildlife-habitat relationships of birds in black oak and mixed-conifer habitats. *In* J. Verner, M.L. Morrison, and C.J. Ralph (editors). *Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates*. University of Wisconsin Press. Madison, WI. 470 pp.

England, A.S. and D.W. Anderson. 1985. Avian Community Ecology in Northern California Chaparral: Evaluation of Wildlife-Habitat Relationship Matrix Models for Chamise-Redshank and Mixed Chaparral. Report prepared for USDA Forest Service Pacific Southwest Forest and Range Experiment Station under Agreement No. PSW-83-0022CA. Department of Wildlife and Fisheries Biology, University of California. Davis, CA..

Hejl, S.J. and J. Verner. 1988. Evaluating avian-habitat relationships in red fir forests of the Sierra Nevada. *Transactions of the Western Section of The Wildlife Society* 24:121-134.

Howell, J.A. 1993. Wildlife Habitat Inventory and Monitoring, Golden Gate National Recreation Area, California: a Pilot Study. Ph. D. Dissertation. University of California. Berkeley, CA. 195 pp.

Laymon, S.A. 1989. A test of the California Wildlife-Habitat Relationship System for breeding birds in valley-foothill riparian habitat. Pages 307-313 *in* Abell, D.A. (technical coordinator) *USDA Forest Service Pacific Southwest*

Forest and Range Experiment Station Technical Report PSW-110, . 544 pp. Berkeley, CA

Purcell, K.L., S.J. Hejl, and T.A. Larson. 1992. Evaluating avian-habitat relationships models in mixed-conifer forests of the Sierra Nevada. *Transactions of the Western Section of The Wildlife Society* 28:120-136.

Raphael, M.G. and B.G. Marcot. 1986. Validation of a wildlife-habitat-relationships model: vertebrates in a Douglas-fir sere. Pages 129-138 *in* J. Verner, M.L. Morrison, and C.J. Ralph (editors). *Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates*. University of Wisconsin Press. Madison, WI. 470 pp.

Verner, J. 1980. Bird communities of mixed-conifer forests of the Sierra Nevada. Pages 198-223 *in* DeGraff, R.M. (technical coordinator) USDA Forest Service Intermountain Forest and Range Experiment Station General Technical Report INT-86. Ogden, UT. 535 pp.

Welsh, H.H., Jr., and A.J. Lind. 1988. Old growth forests and the distribution of the terrestrial herpetofauna. Pages 439-455 *in* Szaro, R.C., K.E. Severson, and D.R. Patton (technical coordinators). USDA Forest Service Rocky Mountain Forest and Range Experiment Station General Technical Report RM-166. Fort Collins, CO. 458 pp.

Welsh, H.H., Jr., and A.J. Lind. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and southwestern Oregon. Pages 394-413 *in* Ruggiero, L.F., K.B. Aubry, A.B. Carey, and M.H. Huff (technical coordinators). USDA Forest Service Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-GTR-285. Portland, OR. 533 pp.

Interpretation of Model Output

Garrison, B.A. 1994. Determining the biological significance of changes in predicted habitat values from the California Wildlife Habitat Relationships System. *California Fish and Game* 80:150-160.

Garrison, B.A., R.A. Erickson, M.A. Patten and I.C. Timossi. 1999. California Wildlife Habitat Relationships System: effects of county attributes on prediction accuracy for bird species. *California Fish and Game* 85(3):87-101.

Garrison, B.A. and T. Lupo. 2002. Accuracy of bird range maps based on wildlife habitat relationships models. Pages 367-375 *in* Scott, J.M., P.J. Heglund, M.L. Morrison, J.B. Haufler, M.G. Raphael, W.A. Wall, and F.B. Samson (editors). *Predicting Species Occurrences: Issues of Accuracy and Scale*. Island Press. Washington, D.C.

CWHR Vegetation Classification System. There are 59 wildlife habitats in the CWHR System to be used with the predictive models for terrestrial vertebrate wildlife species (27 tree, 12 shrub, 6 herbaceous, 4 aquatic, 8 agricultural, 1 developed, and 1 non-vegetated) (Table 1). In addition, stages and special habitat elements are defined.

Stages are defined for virtually all habitats. A stage is a combination of size and cover class for tree-dominated habitats (Tables 2 and 3), age and cover class for shrub habitats, height and cover class for herb habitats, and depth and substrate for aquatic habitats. A field sampling protocol is well-established for determining stages in all vegetated habitats.

CWHR Predictive Models. The predictive model for each species has expert-applied suitability ratings for three life-requisites: breeding, cover, and feeding. For each species, each habitat stage is rated as high, medium, low, or unsuitable for each of these life requirements, as well as a composite rating:

High: Habitat suitability rating where habitat is optimal for species occurrence; habitat can support relatively high population densities at high frequencies. Suitability index value = 1.00.

Medium: Habitat suitability rating where habitat is suitable for species occurrence; habitat can support relatively moderate population densities at moderate frequencies. Suitability index value = 0.66.

Low: Habitat suitability rating where habitat is marginal for species occurrence; habitat can support relatively low population densities at low frequencies. Suitability index value = 0.33

Unsuitable: Habitat stage is unsuitable for species occurrence, and the species where habitat is rated unsuitable is not expected to reliably occur in the habitat. Suitability index value = 0.00.

Table 1. CWHR Habitat Types (Mayer and Laudenslayer 1988).

Tree-Dominated Habitats
Subalpine Conifer (SCN)
Red Fir (RFR)
Lodgepole Pine (LPN)
Sierran Mixed Conifer (SMC)
White Fir (WFR)
Klamath Mixed Conifer (KMC)
Douglas Fir (DFR)
Jeffrey Pine (JPN)
Ponderosa Pine (PPN)
Eastside Pine (EPN)
Redwood (RDW)
Pinyon-Juniper (PJN)
Juniper (JUN)
Aspen (ASP)
Closed-Cone Pine-Cypress (CPC)
Montane Hardwood-Conifer (MHC)
Montane Hardwood (MHW)
Blue Oak Woodland (BOW)
Valley Oak Woodland (VOW)
Coastal Oak Woodland (COW)
Blue Oak-Foothill Pine (BOP)
Eucalyptus (EUC)

Montane Riparian (MRI)
Valley Foothill Riparian (VRI)
Desert Riparian (DRI)
Palm Oasis (POS)
Joshua Tree (JST)
Shrub-dominated Habitats
Alpine Dwarf-Shrub (ADS)
Low Sage (LSG)
Bitterbrush (BBR)
Sagebrush (SGB)
Montane Chaparral (MCP)
Mixed Chaparral (MCH)
Chamise-Redshank Chaparral (CRC)
Coastal Scrub (CSC)
Desert Succulent Shrub (DSS)
Desert Wash (DSW)
Desert Scrub (DSC)
Alkali Desert Scrub (ASC)
Herbaceous Dominated Habitats
Annual Grassland (AGS)
Perennial Grassland (PGS)
Wet Meadow (WTM)
Fresh Emergent Wetland (FEW)
Saline Emergent Wetland (SEW)
Pasture (PAS)
Aquatic Habitats
Lacustrine (LAC)
Estuarine (EST)
Marine (MAR)
Developed Habitats
Cropland (CRP)
Dryland Grain Crops (DGR)
Irrigated Grain Crops (IGR)
Irrigated Hayfield (IRH)
Irrigated Row and Field Crops (IRF)
Rice (RIC)
Orchard - Vineyard (OVN)
Deciduous Orchard (DOR)
Evergreen Orchard (EOR)
Vineyard (VIN)
Urban (URB)
Non-vegetated Habitats
Barren (BAR)

Table 2. Size Class Breakdown for Tree Habitat Types (excluding Desert Riparian, Joshua Tree, Palm Oasis, and Orchard types) (Mayer and Laudenslayer 1988).

CHWR Size Class	CWHR Code	Conifer Crown Diameter (ft.)	Hardwood Crown Diameter (ft.)	Quadratic Mean dbh (inches)
Seedling Tree	1	n/a	n/a	<1.0"
Sapling Tree	2	n/a	<15.0'	1.0"-5.9"
Pole Tree	3	<12.0'	15.0'-29.9'	6.0"-10.9"
Small Tree	4	12.0'-23.9'	30.0'-44.9'	11.0"-23.9"
Medium/large Tree	5	≥ 24.0'	≥ 45.0'	≥ 24.0"
Multi-layered Tree	6	A distinct layer of size class 5 trees over a distinct layer of size class 4 and/or 3 trees, and total tree canopy closure of the layers ≥60.0% (layers must have ≥10.0% canopy cover and distinct height separation)		

Table 3. Canopy Closure Classes for Tree and Shrub Terrestrial Habitats (excluding desert-tree and desert-shrub habitat types) (Mayer and Laudenslayer 1988).

CWHR Canopy Closure Class	CWHR Code	Vegetation Canopy Closure
Sparse Cover	S	10.0% - 24.9%
Open Cover	P	25.0% - 39.9%
Moderate Cover	M	40.0% - 59.9%
Dense cover	D	≥ 60.0%

Appendix A References Cited

CDFG (California Department of Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp>. (Accessed: January 3, 2008).

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp.

APPENDIX B - Calveg/CWHR Crosswalk

The Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) crosswalk to the California Wildlife Habitat Relationships System (CWHR).
[* Modified by RSL for lifeform where indicated; ** Default category for past mapping projects.]

CV Code	CALVEG Type	CALVEG Zone	CWHR Code	CWHR Description
A1	Conifer Agriculture (Xmas Trees)	All	EOR	Evergreen Orchard
A2	Vineyard - Shrub Agriculture	All	VIN	Vineyard
A3	Tilled Earth (barren)	All	BAR	Barren
A4	Orchard Agriculture	All	DOR	Deciduous Orchard
A5	Flooded Row Crop Agriculture	All	RIC	Rice
A6	Pastures and Crop Agriculture	All	CRP	Cropland
A7	Agriculture Ponds/Water Features	All	LAC	Lacustrine
A8	Nurseries (Agriculture)	All	CRP	Cropland
AB	Santa Lucia Fir	All	MHC	Montane Hardwood-Conifer
AC	Alpine Grasses and Forbs	All	ADS	Alpine - Dwarf Shrub
AD	White Bursage	All	DSC	Desert Scrub
AG	Agriculture	All	CRP	Cropland **
AK	Alkaline Flats	All	BAR	Barren
AN	Mendocino Manzanita	All	CSC	Coastal Scrub
AS	Shreve Oak	All	COW	Coastal Oak Woodland
AX	Alpine Mixed Scrub	All	ADS	Alpine - Dwarf Shrub
BA	General Barren	All	BAR	Barren
BB	Bitterbrush	All	BBR	Bitterbrush
BC	Saltbush	All	ASC	Alkali Desert Scrub
BG	Greasewood	All	ASC	Alkali Desert Scrub
BI	Littleleaf Mountain Mahogany	All	SGB	Sagebrush
BL	Low Sagebrush	All	LSG	Low Sage
BM	Curlleaf Mountain Mahogany (shrub)	All	SGB	Sagebrush
BP	Bristlecone Pine	All	SCN	Subalpine Conifer
BQ	Great Basin Mixed Scrub	All	SGB	Sagebrush
BR	Rabbitbrush	All	BBR	Bitterbrush
BS	Basin Sagebrush	All	SGB	Sagebrush
BT	Big Tree	All	SMC	Sierran Mixed Conifer
BX	Great Basin - Mixed Chaparral Transition	All	MCP	Montane Chaparral
BZ	Great Basin - Desert Mixed Scrub	All	SGB	Sagebrush
C1	Ultramafic Mixed Shrub	All	MCH	Mixed Chaparral
CA	Chamise	All	CRC	Chamise - Redshank Chaparral
CB	Salal—California Huckleberry Shrub	All	CSC	Coastal Scrub

CC	Ceanothus Chaparral	All	MCH	Mixed Chaparral
CD	Southern Mixed Chaparral	All	MCH	Mixed Chaparral
CE	Mountain Misery	All	MCP	Montane Chaparral
CG	Greenleaf Manzanita	All	MCP	Montane Chaparral
CH	Huckleberry Oak	All	MCP	Montane Chaparral
CI	Deerbrush	All	MCP	Montane Chaparral
CJ	Brewer Oak	All	MCP	Montane Chaparral
CK	Coyote Brush	1-6-7	CSC	Coastal Scrub
CK	Coyote Brush	2-3-4-5-8-9	MCH	Mixed Chaparral
CL	Wedgeleaf Ceanothus	All	MCH	Mixed Chaparral
CM	Upper Montane Mixed Shrub	All	MCP	Montane Chaparral
CN	Pinemat Manzanita	All	MCP	Montane Chaparral
CP	Bush Chinquapin	All	MCP	Montane Chaparral
CQ	Lower Montane Mixed Chaparral	All	MCH	Mixed Chaparral
CR	Red Shanks Chaparral	All	CRC	Chamise - Redshank Chaparral
CS	Scrub Oak	All	MCH	Mixed Chaparral
CT	Tucker Scrub Oak	All	MCH	Mixed Chaparral
CV	Snowbrush	All	MCP	Montane Chaparral
CW	Whiteleaf Manzanita	All	MCH	Mixed Chaparral
CX	Upper Montane Mixed Chaparral	All	MCP	Montane Chaparral
CY	Mountain Whitethorn	All	MCP	Montane Chaparral
CZ	Semi-Desert Chaparral	All	MCH	Mixed Chaparral
DA	Blackbush	All	DSC	Desert Scrub
DB	Desert Buckwheat	All	DSC	Desert Scrub
DC	Cholla	All	DSS	Desert Succulent Shrub
DE	Arrowweed	All	DRI	Desert Riparian
DF	Pacific Douglas-fir	All	DFR	Douglas-Fir
DG	Douglas-fir—Grand Fir	All	RDW	Redwood
DI	Indigo Bush	All	DSW	Desert Wash
DJ	Spiny Mendora	All	DSC	Desert Scrub
DL	Creosote Bush	All	DSC	Desert Scrub
DM	Bigcone Douglas-fir	All	MHC	Montane Hardwood-Conifer
DO	Ocotillo	All	DSS	Desert Succulent Shrub
DP	Douglas-fir—Ponderosa Pine	All	DFR	Douglas-Fir
DS	Shadscale	All	ASC	Alkali Desert Scrub
DU	Dune	All	BAR	Barren
DV	Desert Mixed Succulent	All	DSS	Desert Succulent Shrub
DW	Douglas-Fir—White Fir	All	DFR	Douglas-Fir
DX	Desert Mixed Scrub	All	DSC	Desert Scrub
EA	Engelmann Spruce	All	KMC	Klamath Mixed Conifer
EP	Eastside Pine	All	EPN	Eastside Pine

EX	Coastal Mixed Hardwood	All	COW	Coastal Oak Woodland
FD	Ephedra (Mormon Tea)	All	DSC	Desert Scrub
FM	Curlleaf Mountain Mahogany (tree)	All	SGB	Sagebrush
FO	Water Birch (<i>Betula occidentalis</i>)	All	DRI	Desert Riparian
FP	Foxtail Pine	All	SCN	Subalpine Conifer
GF	Grand Fir	All	RDW	Redwood
HA	Alkaline Mixed Grasses and Herbs	All	ASC	Alkali Desert Scrub
HC	Pickleweed-Cordgrass	All	SEW	Saline Emergent Wetland
HG	Annual Grasses and Herbs	All	AGS	Annual Grassland
HJ	Wet Grass/Herbs (Wet Meadow)	All	WTM	Wet Meadow
HM	Perennial Grasses and Herbs (Mulesear et. al.)	All	PGS	Perennial Grassland
HS	Cheesebush	All	DSC	Desert Scrub
HT	Tule-Cattail	All	FEW	Freshwater Emergent Wetland
IA	Giant Reed/Pampas Grass	All	VRI	Valley Foothill Riparian
IB	Urban-related bare soil	All	URB	Urban
IC	Non-native/Ornamental Conifer	All	URB	Urban
IF	Non-native/Invasive Forb	All	PAS	Pasture
IG	Non-native/Ornamental Grass	All	URB	Urban
IH	Non-native/Ornamental Hardwood	All	URB	Urban
IM	Non-native/Ornamental Conifer/Hardwood Mixture	All	URB	Urban
IS	Non-native/Ornamental and Invasive Shrub	All	URB	Urban
IW	Developed Water Features	All	LAC	Lacustrine
JC	California Juniper (shrub)	All	JUN	Juniper
JP	Jeffrey Pine	All	JPN	Jeffrey Pine
JT	California Juniper (tree)	All	JUN	Juniper
JU	Utah Juniper	All	JUN	Juniper
KL	Winter Fat	All	ASC	Alkali Desert Scrub
KP	Knobcone Pine	All	CPC	Closed-Cone Pine-Cypress
LP	Lodgepole Pine	All	LPN	Lodgepole Pine
LS	Scalebroom	All	DSW	Desert Wash
MB	Mixed Conifer-Giant Sequoia	All	SMC	Sierran Mixed Conifer
MC	Cuyamaca Cypress	All	CPC	Closed-Cone Pine-Cypress
MD	Incense-Cedar	All	SMC	Sierran Mixed Conifer
MF	Mixed Conifer – Fir	1	KMC	Klamath Mixed Conifer
MF	Mixed Conifer – Fir	2-3-4-5-6-7-8-9	SMC	Sierran Mixed Conifer
MG	Gowen Cypress	All	CPC	Closed-Cone Pine-Cypress

MH	Mountain Hemlock	All	SCN	Subalpine Conifer
MI	Piute Cypress	All	CPC	Closed-Cone Pine-Cypress
MK	Klamath Mixed Conifer	All	KMC	Klamath Mixed Conifer
ML	Baccharis (riparian)	All	DRI	Desert Riparian
MM	Monterey Cypress	All	CPC	Closed-Cone Pine-Cypress
MN	McNab Cypress	All	CPC	Closed-Cone Pine-Cypress
MO	Baker Cypress	All	CPC	Closed-Cone Pine-Cypress
MP	Mixed Conifer – Pine	1	KMC	Klamath Mixed Conifer
MP	Mixed Conifer – Pine	2-3-4-5-6-8-9	SMC	Sierran Mixed Conifer
MP	Mixed Conifer – Pine	7	JPN	Jeffrey Pine
MS	Sargent Cypress	All	CPC	Closed-Cone Pine-Cypress
MT	Tecate Cypress	All	CPC	Closed-Cone Pine-Cypress
MU	Ultramafic Mixed Conifer	1	KMC	Klamath Mixed Conifer
MU	Ultramafic Mixed Conifer	2-3-4-5-6-7-8-9	SMC	Sierran Mixed Conifer
MY	Pygmy Cypress	All	CPC	Closed-Cone Pine-Cypress
NA	Alkaline Mixed Scrub	All	ASC	Alkali Desert Scrub
NB	Desert Mixed Wash Scrub	All	DSW	Desert Wash
NC	North Coastal Mixed Shrub	All	CSC	Coastal Scrub
NM	Riparian Mixed Shrub	All	MRI	Montane Riparian
NQ	High Desert Mixed Scrub	All	DSC	Desert Scrub
NR	Riparian Mixed Hardwood	All	MRI	Montane Riparian
NX	Interior Mixed Hardwood	All	MHW	Montane Hardwood
OS	Beach Sand	All	BAR	Barren
PB	Brewer Spruce	All	KMC	Klamath Mixed Conifer
PC	Coulter Pine	All	MHC	Montane Hardwood-Conifer
PD	Grey Pine	All	BOP	Blue Oak - Digger Pine
PE	Sugar Pine	All	SMC	Sierran Mixed Conifer
PJ	Singleleaf Pinyon Pine	All	PJN	Pinyon - Juniper
PL	Limber Pine	All	SCN	Subalpine Conifer
PM	Bishop Pine	All	CPC	Closed-Cone Pine-Cypress
PO	Port Orford-Cedar	All	KMC	Klamath Mixed Conifer
PP	Ponderosa Pine	All	PPN	Ponderosa Pine
PQ	Fourneedle Pinyon Pine	All	PJN	Pinyon - Juniper
PR	Monterey Pine	All	CPC	Closed-Cone Pine-Cypress

PS	Shore Pine	All	CPC	Closed-Cone Pine-Cypress
PT	Torrey Pine	All	CPC	Closed-Cone Pine-Cypress
PW	Ponderosa Pine - White Fir	All	SMC	Sierran Mixed Conifer
QA	Coast Live Oak	All	COW	Coastal Oak Woodland
QB	California Bay	All	COW	Coastal Oak Woodland
QC	Canyon Live Oak	All	MHW	Montane Hardwood
QD	Blue Oak	All	BOW	Blue Oak Woodland
QE	White Alder	All	MRI	Montane Riparian
QF	Fremont Cottonwood	All	MRI	Montane Riparian
QG	Oregon White Oak	All	MHW	Montane Hardwood
QH	Pacific Madrone	All	COW	Coastal Oak Woodland
QI	California Buckeye	All	MHW	Montane Hardwood
QJ	Cottonwood—Alder	All	MRI	Montane Riparian
QK	California Black Oak	All	MHW	Montane Hardwood
QL	Valley Oak	All	VOW	Valley Oak Woodland
QM	Bigleaf Maple	All	MRI	Montane Riparian
QN	Engelmann Oak	All	COW	Coastal Oak Woodland
QO	Willow (tree)	All	MRI	Montane Riparian
QP	California Sycamore	All	VRI	Valley Foothill Riparian
QQ	Quaking Aspen	All	ASP	Aspen
QR	Red Alder	All	MRI	Montane Riparian
QS	Willow—Aspen	All	MRI	Montane Riparian
QT	Tanoak	All	MHW	Montane Hardwood
QV	Black Walnut	All	VOW	Valley Oak Woodland
QW	Interior Live Oak	All	MHW	Montane Hardwood
QX	Black Cottonwood	All	MRI	Montane Riparian
QY	Willow—Alder	All	MRI	Montane Riparian
QZ	Eucalyptus	All	EUC	Eucalyptus
RD	Redwood—Douglas-Fir	All	RDW	Redwood
RF	Red Fir	All	RFR	Red Fir
RS	Riversidean Alluvial Scrub	All	DSW	Desert Wash
RW	Redwood	All	RDW	Redwood
SA	Subalpine Conifers	All	SCN	Subalpine Conifer
SB	Buckwheat	All	MCH	Mixed Chaparral
SC	Blueblossom Ceanothus	All	CSC	Coastal Scrub
SD	Manzanita Chaparral	All	MCH	Mixed Chaparral
SE	Encelia Scrub	All	DSC	Desert Scrub
SG	Sitka Spruce—Grand Fir	All	RDW	Redwood
SH	Coastal Bluff Scrub	All	CSC	Coastal Scrub
SI	Bladderpod	All	MCH	Mixed Chaparral
SK	Sitka Spruce	All	RDW	Redwood

SL	Coastal Lupine	All	CSC	Coastal Scrub
SM	Sumac Shrub	All	MCH	Mixed Chaparral
SN	Snow/Ice	All	BAR	Barren
SO	Coastal Cactus	All	CSC	Coastal Scrub
SP	Sage (Salvia sp.)	All	CSC	Coastal Scrub
SQ	Soft Scrub-Mixed Chaparral	All	CSC	Coastal Scrub
SR	Sitka Spruce—Redwood	All	RDW	Redwood
SS	California Sagebrush	All	CSC	Coastal Scrub
SY	Chaparral Yucca	All	MCH	Mixed Chaparral
TA	Mountain Alder	All	MRI	Montane Riparian
TB	Bitterbrush – Sagebrush	All	BBR	Bitterbrush
TC	Tree Chinquapin	All	MHW	Montane Hardwood
TM	Horsebrush	All	DSC	Desert Scrub
TN	Black Sagebrush	All	LSG	Low Sage
TR	Rothrock Sagebrush	All	ADS	Alpine - Dwarf Shrub
TS	Snowberry	All	MCP	Montane Chaparral
TT	Big Basin Sagebrush	All	SGB	Sagebrush
TV	Mountain Sagebrush	All	SGB	Sagebrush
TW	Wyoming Sagebrush	All	SGB	Sagebrush
TX	Montane Mixed Hardwood	All	MHW	Montane Hardwood
UB	Urban	All	URB	Urban
UD	Desert Willow	All	DRI	Desert Riparian
UI	Desert Ironwood	All	DSW	Desert Wash
UJ	Joshua Tree	All	JST	Joshua Tree
UL	Catclaw Acacia	All	DSW	Desert Wash
UM	Mesquite	All	DRI	Desert Riparian
UP	Palo Verde	All	DSW	Desert Wash
UT	Tamarisk	All	DRI	Desert Riparian
UW	Fan Palm	All	POS	Palm Oasis
UX	Smoke Tree	All	DSW	Desert Wash
VP	Vernal Pool	All	WTM	Wet Meadow
WA	Water	All	LAC	Lacustrine **
WB	Whitebark Pine	All	SCN	Subalpine Conifer
WD	Dogwood	All	MRI	Montane Riparian
WF	White Fir	All	WFR	White Fir
WJ	Western Juniper	All	JUN	Juniper
WL	Willow (shrub)	All	MRI	Montane Riparian
WM	Birchleaf Mountain Mahogany	All	MCH	Mixed Chaparral
WP	Washoe Pine	All	EPN	Eastside Pine
WW	Western White Pine	All	SCN	Subalpine Conifer

APPENDIX C

NORTH AMERICAN BREEDING BIRD SURVEYS

Reference: Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. [USGS Patuxent Wildlife Research Center](http://www.pwrc.usgs.gov/bbs/), Laurel, MD. <http://www.pwrc.usgs.gov/bbs/>

The North American Breeding Bird Survey (BBS) is a cooperative effort between the U.S. Geological Survey's Patuxent Wildlife Research Center and the Canadian Wildlife Service's National Wildlife Research Centre to monitor the status and trends of North American bird populations. Following a rigorous protocol, BBS data are collected by thousands of dedicated participants along thousands of randomly established roadside routes throughout the continent. Professional BBS coordinators and data managers work closely with researchers and statisticians to compile and deliver these population data and population trend analyses on more than 400 bird species, for use by conservation managers, scientists, and the general public. Data from BBS provide one level of Management Indicator Species (MIS) population monitoring for bird MIS. Droege (1990) and Peterjohn & Sauer (1993) provide detailed descriptions of BBS methodology and rationale.

The BBS, which has been conducted annually since 1966, consists of a continent-wide array of roadside point-count routes. Each route is 39.4 km (24.5 miles) long, and includes 50 3-minute point counts at 0.8 km (.5 mile) intervals. Expert observers conduct point-counts once each year during the peak of the breeding season (June in the Sierra Nevada), recording numbers of every bird species detected within a 0.4 km (.25 mile) radius. BBS routes occur on each of the National Forests in the Sierra Nevada.

BBS data provide the most extensive, long-term data set available on landbird population trends (Siegel and DeSante 1999), and have been used in a wide variety of management and scientific applications (Table 6). More than 270 scientific publications have relied heavily, if not entirely, on BBS data. However, BBS data have some important limitations. Reliable information is produced only for the more common species. Additionally, BBS data are problematic because point counts are conducted exclusively at roadsides, which often include a large proportion of fragmented and edge habitats, and may not be representative of the larger habitat matrix. Nevertheless, BBS data are a tremendously valuable resource for conservation planning (Siegel and DeSante 1999).

Table 6. Applications in which BBS data have been used.

Organization / Agency	Application
U.S. Fish and Wildlife Service and Partners in Flight	Use BBS trends along with other indicators to assess national and regional bird conservation priorities.
Land Management Agencies	BBS data were instrumental in focusing research and management action on neotropical migrant species in the late 1980s, and on grassland species in the mid-1990s.
State Natural Heritage programs and Breeding Bird Atlas projects	BBS data is used to enrich local databases.
Educators	BBS data is often used as a tool to teach biological, statistical, and GIS concepts.

USDI Geologic Survey (USGS) has utilized BBS data to generate indices of population trend, estimates of relative abundance, and contour maps of bird abundance. Although trend is calculated for all scales with data, caution should be used in interpreting any result that was based on fewer than 50 routes. At the regional scale, BBS personnel suggest that a species must be detected on at least 14 different routes to provide enough data to reliably assess the regional population trend of that species (Siegel and DeSante 1999). The BBS data are edited to remove data that are of questionable quality or represent birds that are thought to be migrating rather than breeding (see the metadata for the BBS dataset for more information on editing and quality control of the BBS data).

Indices of Population Trend. Breeding bird surveys, which have been conducted since 1966, provide an index of population trends for many species. Trend analysis is conducted on these data at a variety of scales, including Survey-Wide, California-wide, and Sierra Nevada-Wide. BBS data are collected from routes within and near each National Forest in Region 5 (Table 9).

Based on the BBS data collected over time, trend and relative abundance is calculated for each species. Most calculations are done at each special scale (survey-wide within the species range, Statewide (e.g., California), and Bioregion-wide (e.g., Sierra Nevada). The Trend data is calculated for three time periods: 1966-2005, 1966-1979, and 1980-2005.

Trends are calculated as estimates, and a statistical test is conducted to determine whether the trend is significantly different from 0. The lower the "P value," the less likely that a particular estimated trend would have occurred by chance alone (e.g., a "0.01" indicates a 1% probability that a trend estimate would have occurred by chance). A very low number indicates that the null hypothesis cannot be rejected that the trend is different from 0.

In addition, each estimated trend is calculated with a 95% Confidence Interval (CI) for the trend estimate. The CI is estimated as a multiplicative (constant rate) change in counts over time, with co-variables to adjust for differences in observer quality.

The BBS data set for each species is ranked as to its “regional credibility” (e.g., at the Sierra Nevada scale) (Table 7).

Table 7. BBS data Regional Credibility ranking system (BBS 2005).

Red	This category reflects data with an important deficiency. In particular:	1. The regional abundance is less than 0.1 birds/route (very low abundance),
		2. The sample is based on less than 5 routes for the long term, or is based on less than 3 routes for either subinterval (very small samples), or
		3. The results are so imprecise that a 5%/year change would not be detected over the long-term (very imprecise).
Yellow	This category reflects data with a deficiency. In particular:	1. The regional abundance is less than 1.0 birds/route (low abundance),
		2. The sample is based on less than 14 routes for the long term (small sample size),
		3. The results are so imprecise that a 3%/year change would not be detected over the long-term (quite imprecise), or
		4. The sub-interval trends are significantly different from each other (P less than 0.05, based on a z-test). This suggests inconsistency in trend over time).
Blue	This category reflects data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes	

Bird Relative Abundance. Relative abundance for the species, in birds/route is also calculated for each species at each spatial scale, for 3 timeframes. This number is an approximate measure of how many birds are seen on a route in the region.

Contour Maps of Bird Abundance. USGS has also used the BBS bird survey data to develop contour maps of bird abundance based on mean counts on survey routes. These maps are simple summaries of the raw BBS data, with only a minimal interpolation of information from nearby survey routes. Birds encountered on routes are not necessarily breeding in the area in which they are observed, and many factors can influence the distribution of birds in early summer. Users of these maps should be aware of the limitations of simple counts of birds. These maps are based on exactly the same data that are used in the BBS trend analyses, and route summaries are simple averages of counts on routes over time. However, these are simple averages that do not account for observer differences in counting ability or for other factors that could be controlled in more sophisticated analyses.

Siegel and DeSante (1999) used a population trend classification system (Table 8), which is also referenced in the bird MIS Accounts.

Table 8. Breeding Bird Survey (BBS) population trend classification system (from Siegel and DeSante 1999).

Classification	No. of Routes (n)	Trend (Tr)	Significance of Trend (P)
Definitely increasing	$n \geq 14$	$Tr \geq 1\%$	$P \leq 0.05$
“ “ “ “ “ “ “ “ “ “	$9 \leq n \leq 13$	$Tr \geq 1\%$	$P \leq 0.01$
Likely increasing	$n \geq 14$	$Tr \geq 1\%$	$0.05 < P \leq 0.1$
“ “ “ “ “ “ “ “ “ “	$9 \leq n \leq 13$	$Tr \geq 1\%$	$0.01 < P \leq 0.05$
“ “ “ “ “ “ “ “ “ “	$5 \leq n \leq 8$	$Tr \geq 1\%$	$P \leq 0.01$
Possibly increasing	$n \geq 14$	$Tr \geq 1\%$	$P > 0.1$
“ “ “ “ “ “ “ “ “ “	$9 \leq n \leq 13$	$Tr \geq 1\%$	$0.05 < P \leq 0.1$
“ “ “ “ “ “ “ “ “ “	$5 \leq n \leq 8$	$Tr \geq 1\%$	$0.01 < P \leq 0.05$
“ “ “ “ “ “ “ “ “ “	$1 \leq n \leq 4$	$Tr \geq 1\%$	$P \leq 0.01$
Increasing tendency	$9 \leq n \leq 13$	$Tr \geq 1\%$	$P > 0.1$
“ “ “ “ “ “ “ “ “ “	$5 \leq n \leq 8$	$Tr \geq 1\%$	$0.05 < P \leq 0.1$
“ “ “ “ “ “ “ “ “ “	$5 \leq n \leq 8$	$Tr \geq 5\%$	$P > 0.1$
“ “ “ “ “ “ “ “ “ “	$1 \leq n \leq 4$	$Tr \geq 1\%$	$0.01 < P \leq 0.05$
Definitely decreasing	$n \geq 14$	$Tr \leq -1\%$	$P \leq 0.05$
“ “ “ “ “ “ “ “ “ “	$9 \leq n \leq 13$	$Tr \leq -1\%$	$P \leq 0.01$

“” “” “ “ “			
Likely decreasing	$n \geq 14$	$Tr \leq -1\%$	$0.05 < P \leq 0.1$
“” “” “ “ “	$9 \leq n \leq 13$	$Tr \leq -1\%$	$0.01 < P \leq 0.05$
“” “” “ “ “	$5 \leq n \leq 8$	$Tr \leq -1\%$	$P \leq 0.01$
Possibly decreasing	$n \geq 14$	$Tr \leq -1\%$	$P > 0.1$
“” “” “ “ “	$9 \leq n \leq 13$	$Tr \leq -1\%$	$0.05 < P \leq 0.1$
“” “” “ “ “	$5 \leq n \leq 8$	$Tr \leq -1\%$	$0.01 < P \leq 0.05$
“” “” “ “ “	$1 \leq n \leq 4$	$Tr \leq -1\%$	$P \leq 0.01$
Decreasing tendency	$9 \leq n \leq 13$	$Tr \leq -1\%$	$P > 0.1$
“” “” “ “ “	$5 \leq n \leq 8$	$Tr \leq -1\%$	$0.05 < P \leq 0.1$
“” “” “ “ “	$5 \leq n \leq 8$	$Tr \leq -5\%$	$P > 0.1$
“” “” “ “ “	$1 \leq n \leq 4$	$Tr \leq -1\%$	$0.01 < P \leq 0.05$
Definitely stable	$n \geq 14$	$-0.5\% < Tr < 0.5\%$	--
Likely stable	$n \geq 14$	$-1.0\% < Tr \leq 0.5\%$	--
“” “” “ “ “	$n \geq 14$	$0.5\% \leq Tr < 1.0\%$	--
Possibly stable	$9 \leq n \leq 13$	$-1.0\% < Tr < 1.0\%$	--
Stable tendency	$5 \leq n \leq 8$	$-1.0\% < Tr < 1.0\%$	--

Table 9. BREEDING BIRD SURVEY ROUTES WITHIN AND NEAR (10 MILE RADIUS) OF R5 NATIONAL FORESTS**Eldorado**

RTENO	SEQNO	SRTENAME
14017	182	COTTAGE SPGS
14418	2259	FOREST HILL
14418	2260	FOREST HILL
55019	3656	GARDNERVILLE
14153	2128	GOLD HILL
14095	2063	LUMBERYARD
14420	2261	PLACERVILLE
14419	2262	POLLOCK PINES
14188	2171	RIVERTON
14213	2196	TAHOE NF
14013	2258	WESTVILLE
14082	2050	WOODFORDS
14082	2051	WOODFORDS

Inyo

RTENO	SEQNO	SRTENAME
14084	2054	BENTON
14023	1986	BIG PINE
14096	2064	BODIE
14170	2147	BRIDGEPORT
14426	2266	CRESTVIEW
14426	2267	CRESTVIEW
14154	2129	CROWLEY LAKE
14192	2175	DEEP SPRINGS
14192	2176	DEEP SPRINGS
14030	1994	HAIWEE RES
14116	2087	LONE PINE
14423	2272	PINE MOUNTAIN

Lake Tahoe Basin MU

RTENO	SEQNO	SRTENAME
14418	2259	FOREST HILL
55019	3656	GARDNERVILLE
14419	2262	POLLOCK PINES
14188	2171	RIVERTON
14082	2050	WOODFORDS

Lassen

RTENO	SEQNO	SR TENAME
14180	2161	BUTTE MEADOW
14308	2199	CHAOS CRATER
14308	2200	CHAOS CRATER
14413	2246	CHESTER
14079	2047	COHASSET
14009	1973	EAGLE LAKE
14412	2238	FALL RIVER MILLS
14181	2162	GENESEE
14414	2244	GOUMAZ
14201	2187	HAT CREEK
14008	184	LASSEN PARK
14436	2250	LAST CHANCE
14416	2252	MEADOW VALLEY
14416	2253	MEADOW VALLEY
14003	1967	NUBIEBER
14415	2249	PAXTON
14536	174	SQUAW VALLEY
14161	2136	TEHAMA

Modoc

RTENO	SEQNO	SR TENAME
69039	484	BARNES VAL
14199	2184	BARTLE
14177	2157	CEDARVILLE
14176	2156	CLEAR LK RES
14407	2215	CROWDER FLAT
14165	2141	DAVIS CREEK
14166	2142	DORRIS
14405	2225	HACKAMORE
14073	2040	INGALLS
69253	4349	LAKEVIEW
69139	4348	LAPHAM RES.
14151	2127	LIKELY
14408	2231	MADELINE
14430	2219	MEDICINE MTN.
14430	2220	MEDICINE MTN.
69228	4352	MERRILL
14003	1967	NUBIEBER
14076	2042	RAVENDALE
14406	2221	TIONESTA

Plumas

RTENO	SEQNO	SRTENAME
14413	2246	CHESTER
14433	2251	CHILCOOT
14185	2168	DOWNIEVILLE
14181	2162	GENESEE
14414	2244	GOUMAZ
14184	2167	HIGGINS CORN
14078	2045	JOHNSVILLE
14078	2046	JOHNSVILLE
14436	2250	LAST CHANCE
14417	2255	LITTLE TRUCKEE
14416	2252	MEADOW VALLEY
14416	2253	MEADOW VALLEY
14415	2249	PAXTON
14158	2133	SATTLEY
14536	174	SQUAW VALLEY

Sequoia

RTENO	SEQNO	SRTENAME
14341	2206	CAL HOT SPGS
14027	1990	GRAVESBORO
14110	2081	GREENHORN MT
14110	2082	GREENHORN MT
14030	1994	HAIWEE RES
14128	2102	KELSO VALLEY
14128	2103	KELSO VALLEY
14424	2273	KERNVILLE
14424	2274	KERNVILLE
14424	2275	KERNVILLE
14132	2109	KINGS CANYON
14055	2022	LAKE SUCCESS
14034	1998	ONYX
14054	2021	ORANGE COVE
14423	2272	PINE MOUNTAIN
14117	2088	SILVER CITY
14117	2089	SILVER CITY
14117	2090	SILVER CITY
14425	2276	SOUTH LAKE
14425	2277	SOUTH LAKE
14141	2121	WHITE RIVER
14028	1991	YOKOHL VAL
14028	1992	YOKOHL VAL

Sierra

RTENO	SEQNO	SRTENENAME
14022	1984	BASS LAKE
14022	1985	BASS LAKE
14421	2268	COULTERVILLE
14421	2269	COULTERVILLE
14027	1990	GRAVESBORO
14132	2109	KINGS CANYON
14205	2192	LAKESHORE
14205	2193	LAKESHORE
14191	2174	ONEALS
14054	2021	ORANGE COVE
14156	2131	TUOLUMNE GR
14422	2270	WAWONA
14422	2271	WAWONA

Stanislaus

RTENO	SEQNO	SRTENENAME
14017	182	COTTAGE SPGS
14421	2268	COULTERVILLE
14421	2269	COULTERVILLE
14018	1981	DARDANELLE
14095	2063	LUMBERYARD
14434	2263	STRAWBERRY
14434	2264	STRAWBERRY
14156	2131	TUOLUMNE GR
14082	2050	WOODFORDS
14082	2051	WOODFORDS

Tahoe

RTENO	SEQNO	SRTENENAME
14433	2251	CHILCOOT
14185	2168	DOWNIEVILLE
14418	2259	FOREST HILL
14418	2260	FOREST HILL
14184	2166	HIGGINS CORN
14184	2167	HIGGINS CORN
14078	2045	JOHNSVILLE
14078	2046	JOHNSVILLE
14417	2254	LITTLE TRUCKEE
14417	2255	LITTLE TRUCKEE
14420	2261	PLACERVILLE
14188	2171	RIVERTON
14158	2133	SATTLEY
14213	2196	TAHOE NF
14013	2258	WESTVILLE

Literature Cited.

Droege, S. 1990. The North American Breeding Bird Survey. Pgs. 1-4 in J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U.S. Fish and Wildlife Service, Biol. Rep. 90(1).

Peterjohn, B. G. and J. R. Sauer. 1993. North American Breeding Bird Survey annual summary 1990-1991. Bird Populations 1:1-15.

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight.

APPENDIX D – Snag Decay Class Definitions

From Forest Inventory and Analysis (FIA) National Core Field Guide, Volume 1: Field Data Collection Procedures for Phase 2 Plots, National Core Field Guide, Version 4.0, October 2007.

Decay class stage (code)	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition*	Heartwood condition*
1	All present	Pointed	100	Intact; sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	May be broken	Variable	Sloughing; advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs only	Broken	Variable	Sloughing; fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing; cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

* “Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide”. [Based on Cline, S.P., A.B. Berg, and H.M. Wight. 1980. Snag characteristics and dynamics in Douglas-fir forests, Western Oregon. J.Wildlife Mgmt 44(4):773-786.]